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THE CHAROPHYTA OF MALAYSIA AND ADJACENT COUNTRIES

by

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(Issued December 17, 1940).

CONTENTS.

"It is only by a combination of all methods, herbarium or museum, library, laboratory, field, and breeding, that there is any hope of obtaining satisfactory evidence on the nature and genesis of taxonomic units."
W. B. TURRILL in "The New Systematics", 1940, p. 69.

INTRODUCTORY.

The only hitherto known comprehensive studies on the Netherlands Indian *Charophyta* appeared in 1897 and 1899 in the "Prodrome de la Flore Algologique des Indes Néerlandaises", and were compiled by E. DE WILDEMAN. These papers intend to give a mere enumeration of all *Charophyta* published up to 1896, and therefore mainly contain the species recorded by the famous Charaphytologists ALEX. BRAUN and OTTO NORDSTEDT in 1849, 1882, 1888 and 1889.

In the twentieth century only three papers were published on the *Charophyta* of this area, viz. that by DE WILDEMAN (1900), that by GUTWINSKY (1902), and that by FILARSZKY (1934). The first-named author worked up the specimens occurring in Java, the second one adds two species to this list, whereas the latter studied materials collected in 1928 and 1929 by the German Limnological Sunda Expedition.

The present paper intends to give a taxonomical survey of the

Charophyta of the Netherlands Indies, including some notes on their history, distribution, classification, ecology and economy. The floristic relations in the Archipelago, however, made it desirable to extend this investigation to surrounding countries. I will therefore deal not only with the *Charophyta* occurring in Malaysia, but at the same time with those found in British India (Ceylon incl.), Siam and French Indo-China. As was pointed out by LAM (1937) and defined by VAN STEENIS (1937), the term Malaysia comprises the Malay Archipelago *sensu latiore,* the Malay Peninsula, the Philippines, and New Guinea inclusive.

However, the war made it impossible to study all the types of the species occurring outside Malaysia; therefore, and, at the same time, in order to have an easy survey of the Malaysian species, the former are printed in small type. Moreover, I have mentioned the Australian specimens and their localities for the species occurring in the area under discussion.

I had the opportunity to study a great number of specimens and books, thanks to the kindness of the directors of the herbaria and libraries, whom I tender my sincere thanks for their valuable assistance. In quoting the herbaria in the Taxonomical Part of the present paper I made use of the "International List of Abbreviations" proposed by LANJOUW (1939, p. 142).

BERLIN-DAHLEM, Botanischer Garten und Botanisches Museum	B
BUDAPEST, Sectio Botanico Musei Nationalis Hungarici	Bu-Mus
BUITENZORG, Herbarium en Museum voor Systematische Botanie van 's Lands Plantentuin	Bz
KEW, Royal Botanic Gardens	K
LEIDEN, Rijksherbarium	L
PARIS, Muséum National d'Histoire Naturelle, Laboratoire de Cryptogamie	P
SINGAPORE, Botanic Gardens	Si
STOCKHOLM, Naturhistoriska Riksmuseet, Botaniska Avdelningen	S

The materials put at my disposal mainly consisted of dried specimens, though some of them were preserved in fluid. It may be emphasized that the preservation in alcohol (70 %) or in formalin (1 %) is much more convenient for *Charophyta*; the specimens are less damaged and easier to identify.

Yet, at the end of this study, I feel something of the truth in the words of SALISBURY (1939, p. 404): "When based mainly or entirely on herbarium material monographs are liable to be both a snare and a delusion". Indeed, a real understanding of some species, e. g. *Nitella pseudoflabellata, N. microcarpa, Chara fibrosa, C. vulgaris, C. zeylanica*, is only possible by involving the experiment as well as ecological studies. At the time I was not able to carry these out, but I would reply SALISBURY with the words of TURRILL (1940, p. 69): "No method is sufficient by itself, yet each is essential". In Chapter III, § 4 of the General Part I will refer at some length to this point and to TURRILL's words quoted as a motto.

I am deeply indebted to Dr H. J. LAM, Director of the "Rijksherbarium" and Professor of Systematic Botany at the Government University, Leiden, for his suggestion to work up this interesting group, for his helpful criticism and for the continual sympathy he has shown in the progress of my work. I am also much obliged to my colleagues, members of the staff of the "Rijksherbarium", especially to Dr J. TH. HENRARD, for nomenclatural informations, and to Miss Dr J. TH. KOSTER and Dr S. J. VAN OOSTSTROOM, for their kind assistance in various phases of my investigation. I should like also to thank Miss Dr M. F. E. NICOLAI, Leiden, for kindly reading through the manuscript of Chapter IV.

My sincere thanks are further due to Mr G. O. ALLEN, Godalming, Surrey, England, for the interest with which he followed the advance of this study and for the instructive correspondence concerning some of the species. I have also to thank Mr S. C. DIXIT, Bombay, India, for a duplicate of the type of *Chara pashanii*, and Prof. Dr A. THIENEMANN, Plön, Germany, for informations on the economy.

GENERAL PART

CHAPTER I. **History.**

§ 1. First collection of Malaysian Charophyta. Though one hundred and one years have elapsed since ALEX. BRAUN stated (1839, p. 310): "Von den ostindischen Inseln, aus China, Japan und Siberien sind noch keine Charen bekannt", the present investigations brought to light that the first *Charophyta* from the Malay Archipelago were collected as early as 1828. In that year, A. ZIPPEL, assistant-curator at "'s Lands Plantentuin", Buitenzorg, took part in an expedition from Batavia via Makassar and Amboina to the S.W. coast of New Guinea (BACKER, 1936). As is mentioned underneath, *Nitella pseudoflabellata* var. *mutila* and *Chara corallina* were collected in Amboina. Obliged to return on account of bad health, ZIPPEL reached S. Timor, where he died in the same year. In this island *Nitella microcarpa* var. *microglochin* was collected. The three specimens mentioned were dried and are still in a good condition, the former two in the "Rijksherbarium" at Leiden, the latter at Berlin.

§ 2. Historical review of the Malaysian Charophyta. Up to the present time no historical review of the identification of the Malaysian *Charophyta* was made. The following notes intend to make an attempt thereto.

The first printed record of any Malaysian Charophyte appeared as long ago as 1837 in the "Flora de Filipinas", in which BLANCO gives a description of a new species *Conferva littoralis*, a "Conferva de playas", which is *Chara zeylanica* f. *armata*. In the second (1845) and third (1879, part 3) edition of BLANCO's Flora the species is still mentioned as a *Conferva*.

The earliest publication on the Netherlands Indian *Charophyta* was, as far as I am aware, by BRAUN in 1849 in HOOKER's "Journal of Botany". Two species are given: *Chara coronata* var. *orientalis*, from Java, which variety was described as new, and *Chara javanica* from Java, described as a new species; the former has now to be named *Chara Braunii* var. *oahuensis* f. *javanica*, and the latter is still a doubtful species, which has never been collected again and the type specimen seems to have disappeared (being, however, most probably

identical with *C. zeylanica*). In 1851, LLANOS, in "Fragmentos de algunas plantas Filipinas no incluidas en la Flora de las islas", described *Chara congesta* as a new species from the Philippines, which appears to be identic with *C. corallina*, at the time being an addition to the *Charophyta* flora. This species is also mentioned in BLANCO's third (1880, part 4) edition. In ZOLLINGER's "Systematisches Verzeichnis" (1854) is added *Chara furcata* ROXB. from Celebes, which later appeared to belong to the genus *Nitella*. WALLMAN, in "Actes de la Société Linnéenne de Bordeaux" (1856), records only *Chara javanica*, but did not give a description of this species either. In 1866, BRAUN, in G. VON MARTENS' "Die Preussische Expedition nach Ost-Asien", mentions two *Charophyta*, both from Borneo, viz. *Nitella pseudoflabellata* (now *N. pseudoflabellata* var. *mutila*) and *N. polyglochin* var. *Zollingeri* (now *N. furcata* var. *Zollingeri*), the former being at the time an addition.

In 1868, in "Monatsbericht der Königlichen Akademie der Wissenschaften, Berlin", BRAUN states that a form of *Nitella acuminata* occurs in Java and in Mindanao. In "Proceedings of the Asiatic Society" (1870), G. VON MARTENS mentions "*Nitella* sp. nov.?", collected by S. KURZ in Java (No. 123); the name for this specimen has to be *N. pseudoflabellata* var. *mutila*.

BRAUN's manuscripts, published after his death by O. NORDSTEDT in "Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin" (1882), contains the descriptions and some illustrations of the following species: (1) *Nitella acuminata* var. *indica* from Java (now *N. acuminata* var. *subglomerata*), and var. *subglomerata* from the Philippine Islands; (2) *N. axillaris* var. *javanica* from Java (now *N. axillaris*); (3) *N. pseudoflabellata* from Java (now *N. pseudoflabellata* var. *mutila*), and var. *mutila* from Borneo; (4) *N. oligospira* f. *javanica* from Java; (5) *N. polyglochin* var. *Zollingeri* from Soembawa, Celebes, Java and Borneo (now *N. furcata* var. *Zollingeri*) and f. *nicobarica* from the Nicobars (now var. *nicobarica*); (6) *Chara corallina* var.? *basilaris* from the Philippines (now *C. corallina*); (7) *C. coronata* var. *leptosperma* f. *javanica* from Java (now *C. Braunii* var. *oahuensis* f. *javanica*); (8) *C. flaccida* var. *Gaudichaudii* from Celebes and the Marianne Islands, and var.? *oligarthra major* from Borneo (both now *C. fibrosa* ssp. *flaccida*); (9) *C. gymnopus* var. *ceylonica* from Bali (now *C. zeylanica* f. *typica*); the numbers (2), (4), (6), (8) and (9) being new for Malaysia.

In 1888, NORDSTEDT, in "Hedwigia", adds *Nitella oligospira* f. *indica*

from Java and the Nicobars to the list. The same author, in "Lunds Universitets Årsskrift" (1889), describes the decoration of the outer coloured membrane of the oospores of some of the known species, whereas *Chara gymnopitys* var. "α" (now *C. fibrosa* ssp. *gymnopitys* var. *typica*) from New Guinea is added. In 1889 again, NORDSTEDT, in "Die Forschungsreise S. M. S. 'Gazelle', IV. Th., Bot.", describes *Nitella acuminata* from Amboina (now *N. acuminata* var. *Bélangeri*), *N. polyglochin sens. lat.* (now *N. microcarpa* var. *microglochin*) from Timor, *Chara gymnopitys* f. *longibracteata* (now *C. fibrosa* ssp. *gymnopitys* var. *typica*) from Timor, and *C. brachypus* from Timor; *N. microcarpa* var. *microglochin* and *C. brachypus* being additions. To "*C. gymnopitys*" NORDSTEDT has added that it is distributed "im östlichen Afrika, im Ostindien, Borneo, auf den Mariannen und Celebes". It is noteworthy that this is the distribution of "*C. flaccida*" as cited in the "Fragmente" (1882, p. 129), which is the only publication from which the distribution could be taken. I therefore deem it most probable that NORDSTEDT has erroneously cited the distribution of *C. fibrosa* ssp. *flaccida* under *C. fibrosa* ssp. *gymnopitys*.

DE WILDEMAN, in "Prodrome de la Flore Algologique des Indes Néerlandaises" (1897, 1899), summarizes all the then-known *Charophyta* of the Netherlands Indies and gives a table of their distribution; 5 species of *Nitella* and 5 of *Chara* are cited. To these numbers must be added *Nitella microcarpa* var. *microglochin*, as later on *N. polyglochin* was found to comprise both that species and *N. furcata*, and *Chara fibrosa* ssp. *flaccida*, since DE WILDEMAN did not cite it, although it was recorded by BRAUN & NORDSTEDT. No further addition was made to this number by DE WILDEMAN's "Essai d'une Flore Algologique de Java", published under the title of "Les Algues de la Flore de Buitenzorg" (1900), in which the Javanese *Charophyta* were amply described. Up to 1900 not a single species was recorded from the Malay Peninsula.

Summarizing, we see that at the beginning of the 20th century the following *Charophyta* were known for Malaysia:

Nitella	*Chara*
(1) — *acuminata* var. *Bélangeri*	(1) — *corallina*
— — var. *subglomerata*	(2) — *Braunii* var. *oahuensis* f. *javanica*
(2) — *axillaris*	(3) — *fibrosa* ssp. *gymnopitys* var. *typica*
(3) — *pseudoflabellata* var. *mutila*	— — ssp. *flaccida*
(4) — *oligospira* f. *javanica*	

Nitella	*Chara*
(5) — *furcata* var. *Zollingeri*	(4) — *brachypus*
— — var. *nicobarica*	(5) — *zeylanica*
(6) — *microcarpa* var. *microglochin*	

Gutwinski, in the "Bulletin International de l'Académie de Science de Cracovie" (1902), mentions from Java: *Nitella oligospira* f. *indica* and *Chara gymnopitys* or *C. flaccida* (unripe oogonia), both determined by Nordstedt (now *C. fibrosa* ssp. *gymnopitys* or ssp. *flaccida*).

In 1912, H. and J. Groves, in "Philippine Journal of Science", give the first review of the *Charophyta* of the Philippine Islands. Their list contains a number of new records for the Philippines, whereas at the same time *Chara fibrosa* ssp. *Benthamii* is added to the Malaysian *Charophyta* flora. H. Groves, in "Journal of the Linnean Society, Botany" (1914), records *Nitella acuminata* var. *indica* from British North Borneo (now *N. acuminata* var. *subglomerata*). Merrill, in his "Species Blancoanae" (1918), mentions from the Philippines: *Chara corallina* and *C. zeylanica* formerly published under the names of *Chara congesta* and *Conferva littoralis* respectively.

In the "Journal of the Straits Branch, Royal Asiatic Society" (1919), Ridley gives the descriptions of the *Charophyta* of the Malay Peninsula, as far as I am aware, the first printed records; they are: *Nitella acuminata* (now *N. acuminata* var. *subglomerata*), *N. pseudoflabellata* (now *N. pseudoflabellata* var. *mucosa*), *N. microcarpa* (now *N. microcarpa* var. *microglochin* and var. *Glaziovii*) and *Chara gymnopitys*; *N. pseudoflabellata* var. *mucosa* and *N. microcarpa* var. *Glaziovii* being additions to the Malaysian list. In 1924, J. Groves, in the "Journal of the Linnean Society, Botany", adds to these *Charophyta* from the Malay Peninsula: *Nitella mucosa* (now *N. pseudoflabellata* var. *mucosa*), *N. microcarpa* (now *N. microcarpa* var. *microglochin*), *N. furcata*, *Chara flaccida* (now *C. fibrosa* ssp. *flaccida*) and *C. zeylanica*, also recorded from the Andamans and the Cocos Islands, whereas *C. corallina* is only recorded from the S. Andaman Islands.

Biswas, in the "Journal of the Federated Malay States Museums" (1929), writes that he obtained *Charophyta* from the hotsprings area of Kuala Lumpur, but did not mention the names.

Filarszky, in the "Archiv für Hydrobiologie, Suppl. Bd. 12, Tropische Binnengewässer" (1934), describes the *Charophyta* collected by the German Limnological Sunda Expedition and added the following species to the flora of Malaysia: *Nitella sumatrana*, *N. bipartita* both

from Sumatra, *N. pseudograciliformis* (now *N. mucronata* var. *pseudograciliformis*) from Bali, *Tolypellopsis* (*Nitellopsis*) *simplicissima* from Sumatra (now *Chara australis* var. *Vieillardii* f. *simplicissma*) and *Chara fulgens* from Bali. The other species and forms appear to be identic with already described ones, viz. *Nitella polyglochin* f. *javanica* with *N. furcata* var. *Zollingeri*, *Chara haitensis* and *C. variabilis* with *C. zeylanica* f. *armata*, and *C. brachypus* f. *robusta* with *C. brachypus*. It must be stated that this is the first publication which contains a good number of ecological data thanks to the investigations of the Sunda Expedition.

The same author, in "Mathematischer und Naturwissenschaftlicher Anzeiger der Ungarischen Akademie der Wissenschaften" (1937), mentions a new *Nitella* for Malay Peninsula, viz. *N. fascicularis*, but the species is insufficiently described and can therefore at present not be added to the Malaysian list.

Surveying the publications of the 20th century up to 1939, to the list of 1900 have to be added:

Nitella

(3) — *pseudoflabellata* var. *mucosa*
(4) — *oligospira* f. *indica*
(6) — *microcarpa* var. *Glaziovii*
(7) — *sumatrana*
(8) — *bipartita*
(9) — *mucronata* var. *pseudograciliformis*

Chara

(2) — *Braunii* var. *oahuensis* f. *leptocoronulata*
(3) — *fibrosa* ssp. *Benthamii*
(6) — *fulgens*
(7) — *australis* var. *Vieillardii* f. *simplicissima*

The Taxonomical Part of the present paper contains the descriptions of 12 species of *Nitella*, 1 species of *Nitellopsis* and 11 species of *Chara* occurring in Malaysia, whereas a good number of varieties and forms (partly new) are described. In total, to the list 3 *Nitella* species are now added, viz. *N. moniliformis*, n. sp., *N. tumulosa*, n. sp., and *N. Alleninda*, n. sp., further 1 *Nitellopsis* species, viz. *Nitellopsis sarcularis*, n. sp., and 4 *Chara* species, viz. *C. hydropitys*, *C. inermis*, n. sp., *C. erythrogyna* and *C. globularis*, the last two with some doubt, as I did not see the original specimens.

§ 3. First collection and record of Indian Charophyta. According to BRAUN (1849, p. 300), the first Charophyte of India, *Chara zeylanica*, was collected in Ceylon in 1798 by LEBECK, an official of the E. India Company.

The oldest specimen which came under the eyes of the writer was *Chara corallina*, being collected in 1799 at Tranquebar at the Coromandelian coast without mention of the collector's name. The specimen is dried and is preserved in a good state in the Berlin herbarium. This species was collected together with *Chara setosa* (now *C. brachypus*) and *C. zeylanica*, as was shown in the first paper dealing with Indian *Charophyta*, entitled: "Ueber die Gattung *Chara*". This paper was published by WILLDENOW in 1806 in "Sammlung der deutschen Abhandlungen welche in der Königlichen Akademie der Wissenschaften zu Berlin vorgelesen worden in den Jahren 1803". The French translation of this paper, however, bears on the frontispiece as year of publication 1805!

CHAPTER II. **Distribution and dispersal.**

§ 1. Distribution of the Malaysian and Indian Charophyta. The species composing the *Charophyta* flora of Malaysia are heterogeneous in origin. Some of the species have come to the richest display of their potentialities in Malaysia, while others have their main distribution in more northern or southern areas. Especially the Malay Archipelago, situated at either side of the equator between the Asiatic and Australian continents, may be expected to be a meeting place of northern and southern species, some of which reach their boundaries here. Though it is at present impossible to obtain a real understanding of the origin of the Malaysian *Charophyta* flora, some remarks on this subject may be of interest.

For this purpose table I was established, showing the distribution of the *Charophyta* described in this paper inside as well as outside the area under discussion. The primary difficulty for a non-monographer in compiling such a statement is that many authors do not accept the same delimitation for the same species. Another point is that he has to follow without possible criticism the statements given in literature. In view of the last objection different signs are used, explained at the base of the table mentioned.

For the indication of the districts in Malaysia in table I and in the Taxonomical Part the "Lijst van de voornaamste aardrijkskundige namen in den Nederlandsch-Indischen Archipel" (1923) was used, whereas the records from India were arranged with the aid of CLARKE's paper: "On the subsubareas of British India" (1898). The English orthography of the geographical names outside the Netherlands Indian Archipelago is in agreement with "The Oxford advanced Atlas" by

BARTHOLOMEW (1936); for the orthography of the Netherlands Indian names I made use of the above-quoted "Lijst".

As may be seen from table 1, 18 species out of the 24 occurring in Malaysia are represented in Java, then follows Sumatra with 10 species, Malay Peninsula and the Philippines with 8 each, Borneo and New Guinea with 6 each, Bali with 4 and the remaining islands with less than 4 species. This sequence is evidently due to the state of exploration of various parts of the Archipelago. It is probable that, when more extensive collections are made especially in the Lesser Sunda Islands and in the Moluccas, not only the given numbers will be better equilibrated, but some more species may be found to occur in Malaysia. In addition, however, this sequence confirms at the same time that the Lesser Sunda Islands with their longer period of drought present less favourable conditions for the growth of *Charophyta* than the Greater Sunda Islands (cf. this Chapter, § 3). At present there is only one collector, the German Limnol. Sunda Expedition excepted, who brought home 8 numbers of *Charophyta*, all others did not collect more than 4 numbers! (cf. index to collectors' numbers). There is, therefore, no reason to lay much stress upon the 5 species, which are hitherto only recorded for one island of the Archipelago only.

It becomes more and more evident that *Charophyta* with a small area are very rare, most of the species having a wide distribution. Of the 61 *Charophyta* mentioned in the present paper 6 are cosmopolitan (*Nitella hyalina*, *Tolypella glomerata*, *Chara Braunii*, *C. contraria*, *C. vulgaris* and *C. globularis*), while 12 species occur in all continents but one (viz. not in Australia: *Nitella acuminata*, *N. mucronata*, *N. tenuissima*, *Chara canescens*, *C. aspera* and *C. delicatula*; not in Europe: *Nitella oligospira*, *N. furcata*, *N. microcarpa*, *Chara fibrosa* and *C. zeylanica*; not in Africa: *Nitella batrachosperma*).

Moreover, the table shows that out of the 61 *Charophyta*, 25 are represented in Africa (19 in N. and 19 in S. Africa), 22 in America (20 in N., 14 in C. and 14 in S. America), 17 in Europe and 17 in Australia.

The *Charophyta* flora of Malaysia may be better understood on involving the total area of the species in accordance with the latitude. For that purpose the following list based on the zones of latitude may be of some use, in which the Malaysian species are denoted by an asterisk.

I. *In all parts except the Polar regions* (c. 67°.30′ N. lat. 67°.30′ S. lat.): All cosmopolitan species, and, moreover, **Nitella acuminata*,

**N. pseudoflabellata, N. batrachosperma, *N. oligospira, *N. furcata, *N. mucronata, N. tenuissima, *N. microcarpa, Tolypella prolifera, *Chara fibrosa, *C. hydropitys, C. delicatula* and **C. zeylanica.*

II. *Tropics* (between the Tropic of Cancer and the Tropic of Capricorn, c. 23°.30′ N. lat.—23°.30′ S. lat.) : **Nitella axillaris, *N. bipartita, N. patula, N. leptodactyla, *N. tumulosa, *Chara corallina, *C. succincta, *C. erythrogyna, *C. brachypus.*

III. *Northern Temperate* (between the Arctic circle and the Tropic of Cancer, c. 67°.30′ N. lat.—23°.30′ N. lat.) : *Nitella tuberculata, N. mirabilis, N. flagelliformis, N. flagellifera, N. Wattii, Tolypella hispanica, Nitellopsis obtusa, Lychnothamnus barbatus, Chara Wallichii, C. canescens, C. aspera, C. infirma, C. connivens.*

IV. *Northern Tropics* (between the Tropic of Cancer and the Equator, c. 23°.30′ N. lat.—0°) : **Nitella sumatrana, N. dualis, N. globulifera, N. Annandalei, N. dictyosperma, N. burmanica, N. superba, N. elegans, N. polycarpa, Chara pashanii, C. nuda, C. burmanica, C. Grovesii* and *C. Handae.*

V. *Southern Tropics* (between the Equator and the Tropic of Capricorn, 0°—c. 23°.30′ S. lat.) : **Nitella moniliformis, *N. Alleninda, *Nitellopsis sarcularis, *Chara fulgens, *C. inermis.*

VI. *Southern Temperate* (between the Tropic of Capricorn and the Antarctic circle, c. 23°.30′ S. lat.—67°.30′ S. lat.) : thus far no species known, with one exception, and this is not surprising, as the land areas in this zone are very small. The exception is **Chara australis,* but its range extends as far northwards as 13° N. lat.

The results of this list will become more striking, if shown in percentages. In table II this is done for two categories separately, viz. the 24 species occurring in Malaysia only and the 37 species occurring in India respectively.

TABLE II.

Zones of latitude / Number of species	I Cosmop.	II Trop.	III N.Temp.	IV N.Trop.	V S.Trop.	VI S.Temp.
Malaysian species (24 = 100 %)	46 %	25 %	0 %	4 %	21 %	4 %
Indian species (37 = 100 %)	22 %	8 %	35 %	35 %	0 %	0 %

This table shows that exactly 50 % of the Malaysian *Charophyta* are recorded for the tropics only (groups II, IV and V), 4 % occurs mainly in the Southern Temperate zone and 46 % has a nearly world-wide distribution. At present no Northern Temperate species is recorded from Malaysia.

Of the Indian species, on the contrary, 43 % is restricted to the tropics only, 22 % is cosmopolitan, 35 % occurs in the Northern Temperate zone only, no species being recorded from the Southern Temperate region.

§ 2. The Origin of the Malaysian Charophyta. Though a definite conclusion must be reserved especially till more is known of the Australian *Charophyta*, it may be seen both from the above statement and from table II that the Malaysian *Charophyta* are purely tropical species, and that it seems improbable that species, occurring north the Tropic of Cancer, may be expected in Malaysia, and conversely, that species which are now mentioned as "endemics" for Malaysia may some time be collected outside the tropics.

The Indian species, on the other hand, have a more northern distribution; it is not very likely that species now recorded as "endemics" are to be found in the Southern Temperate zone; on the contrary, it is rather probable that, if in some other place, they will be collected north of the Tropic of Cancer only.

If all *Charophyta* known at present were classified in this way and if the thus obtained knowledge of their distribution would be considered in combination with the characters of Malaysian species (cf. tables IV—VII) it would be more or less possible to prophesy which species are yet likely to be found in Malaysia.

The percentage of cosmopolitan species is remarkably high and this is doubtlessly due to the easy mode of dispersal.

§ 3. Seasonal distribution. A review of the periods in which the Malaysian *Charophyta* are found is given in table III. For India I may refer to the statements of G. O. ALLEN (1925, pl. 5; 1928, p. 66) and PAL (1932, p. 51).

The main factor for the seasonal distribution of the *Charophyta* is water and, occasionally, the rainfall. In agreement herewith, table III shows that, as a whole, *Charophyta* with ripe oospores have been found for the greater part between February and May, i. e. some months after the onset of the wet monsoon. However, the area under discussion is too extensive to allow generalization, as the distribution of the rainfall throughout the year differs, of course, for the dif-

TABLE III.

Seasonal distribution of the Malaysian *Charophyta*[1]).

Species	Distribution[2])	Oct.	Nov.	Dec. (W. (wet) monsoon)	Jan. (W. (wet) monsoon)	Feb. (W. (wet) monsoon)	Mar. (W. (wet) monsoon)	Apr.	May	Jun. (E. (dry) monsoon)	Jul. (E. (dry) monsoon)	Aug. (E. (dry) monsoon)	Sep.
Nitella													
- acuminata	M.P., S., J., Bo., Ph., A.												
- sumatrana	S.												
- axillaris	J.												
- bipartita	S., J.												
- pseudoflabellata	M.P., S., J., Bo., A., N.G.												
- moniliformis	J.												
- oligospira	A.& N., M.P., J., N.G.												
- tumulosa	N.I., J.												
- furcata	A.& N. M.P., J., B., C., Ph., Sw.												
- mucronata	J., Ba.												
- microcarpa	M.P., S., J., Bo., C., T., N.G.												
- Allenind**a**	J.												
Chara													
- australis	S., N.G.												
- corallina	A.& N., S., J., Bo., Ph., A.												
- fulgens	Ba.												
- Braunii	S., J., Ph., L.												
- fibrosa	M.P., S., J., Bo., C., Ph., Sb., T., K.I., N.G.												
- hydropitys	M.P., S., J., Ph.												
- inermis	Sb.												
- brachypus	J., Ph., Ba., T., N.G.												
- zeylanica	A.& N., M.P., S., J., Ph., Ba., K.I.												

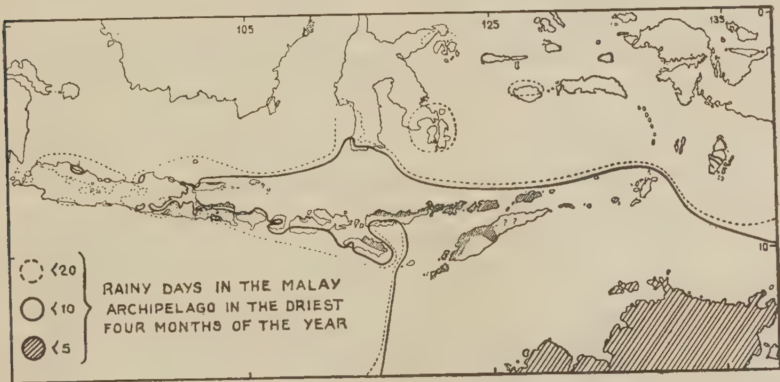
ferent parts of the Archipelago. In this respect the maps of BOEREMA (1924) and BRAAK (1925) are very instructive.

The data of these authors were used by LAM (1934) for the composition of a map partly reproduced in this paper as map I. This map shows the areas in the Netherlands Indian Archipelago with 0—5, 5—10, 10—20 and with more than 20 rainy days in the driest 4 months of the year. It was supposed that more than 20 rainy days in the dry monsoon correspond with at least 2,000 mm rain per year.

[1]) The seasonal distribution of *Nitellopsis sarcularis, Chara erythrogyna* and *C. globularis* is unknown.

[2]) In this column the localities quoted in table I are indicated by their initials.

The writer is of the opinion that this amount is sufficient for not too shallow waters to allow a perennial growth of *Charophyta*, on the condition that this amount is equally distributed over the year. On account of this, the areas of *Charophyta* with a long seasonal distribution (cf. table III) may be expected to correspond with the region outside the 20 days line. Now, this is the case with *Nitella acuminata, N. pseudoflabellata, Chara Braunii, C. fibrosa, C. hydropitys,* and *C. zeylanica*. These species occur in the Greater Sunda Islands and besides, in Lombok, Soemba and Timor, which are for their greater part situated between the 5 and 10 days lines. Species



Map I. Severity of the dry monsoon in the Malay Archipelago, as indicated by the number of rainy days (from LAM).

with a seasonal distribution of over 5—6 months are *Nitella oligospira, N. furcata* and *N. microcarpa*; these occur also in the Greater Sunda Islands and, moreover, in Soembawa and Timor, the latter two lying between the 5 and 10 days lines. However, the correlation mentioned could thus far not be stated for several other species, which occur outside the 20 days line, and yet have a short seasonal distribution. This may be ascribed to the fact that they are recently described ones, viz. *Nitella sumatrana, N. bipartita, N. moniliformis, N. tumulosa, N. Alleninda* and *Chara fulgens.*

The conclusion also holds true for the drier regions. Such long-known species as *Nitella axillaris, Chara corallina* and *C. brachypus,* whose areas are mainly included between the 10 and 20 days lines, have a short seasonal distribution. *Chara inermis,* nov. spec., at

present only known from Soembawa which lies mainly between the 5 and 10 days lines, was collected with ripe oospores in March, which agrees with the maximum rainfall for this island, viz. in December and February. It must be stipulated that the line encompassing the areas with less than 5 rainy days in the driest 4 months encloses the N. parts of some of the larger Lesser Sunda Islands. In these parts *Charophyta* are hardly to be expected, as well as in the 5—10 days lines area, including the other parts of the Lesser Sunda Islands except a small part of S.W. Flores, S.W. Soemba, S.W. Soembawa, W. Lombok and nearly the whole of Bali, which are less dry.

The small number of species found in the Lesser Sunda Islands is, therefore, not only due to the state of exploration in the Malay Archipelago, but also to the severity of the dry monsoon.

§ 4. Dispersal. *Charophyta* are submerged inhabitants of the stagnant waters and occasionally of slowly running waters. The plants are very fragile and the dispersal by means of fragmentation is very well possible, as the fragments are able to withstand long desiccation (cf. ZANEVELD, 1939, p. 385). Another method of vegetative reproduction is by the starch-bearing bulbils occurring at the lower stem- and root-nodes. As the rooting portions of a plant are very seldom collected, it is often not to be stated with certainty in which species they occur. As far as I know, they are found in the following Indian and Malaysian species: *Chara succincta, C. aspera, C. delicatula, C. vulgaris* and *Nitellopsis obtusa.*

Finally the hard oospores produced in abundant masses at the nodes of the branchlets or at the base of the whorls procure a very important means of dispersal. According to NORDSTEDT (1889, p. 3), the outer membrane is provided with suberin and silicic acid, whereas earlier DE BARY (1875, p. 381) has stated that it is composed of lignin. Fragments with bulbils and mature oospores may get detached, fall into the mud and may thus be transported by the stream. However, this method cannot be an important one, as the plants occasionally occur in these places.

When the species grow in or near an estuary it is possible that the oospores are transported by sea currents. In this connection it is of importance that DIXIT (1931, p. 205) describes *Nitella hyalina, Chara succincta* and *C. zeylanica* from the saltwater mudflats of the island of Salsette (N. of Bombay), which are submerged when the tide is in. Though there are no data available, I deem it most probable that

the oospores do not loose their viability when immersed in sea-water for a fairly considerable time.

As the dispersal by wind is not to be considered, there remains only the dispersal by animals. This must be the primary method for the dispersal of these plants and it is probably effectuated both by means of simple adhesion and of passing through the alimentary canal. The animals involved are, of course, such which regularly visit stagnant waters. According to RIDLEY (1931) these are mainly birds, but also mammals, of which the rhinoceros is marked with certainty. Fragments of the plants, with or without oospores, are eaten by a number of migratory water-fowl such as teal, cormorants, jacanas, herons, sandpipers and ducks; of the latter MACATEE (1915, p. 33) mentions 14 species. The oospores are swallowed and are still germinative after having passed the alimentary canal. In this way the *Charophyta* species can be transported over long distances. In case portions of a plant or whole plants adhere to the fur or feathers of a mammal or a bird, these sooner or later become dislodged and are therefore transported over comparatively small distances only. The same holds true for the adhesion to the feet of an animal in mud in which it has been trampling.

RIDLEY (1919, p. 163) remarks on the herbarium label to *Nitella microcarpa* var. *microglochin* that he found the footprint of a rhinoceros in the middle of the jungle of Gunong Tungal, in the Dindings, on the west coast of the Malay Peninsula, where water had collected, quite filled up with these plants. This species occurred only in rice-fields a few miles away, where the animal had probably picked it up. These animals often wander through the jungle, making a regular round for a month or more, and consequently may carry and distribute the oospores or plant-fragments. The oospores or fragments may occasionally become dislodged and after the rain having filled the hole of their prints, the oospore is able to germinate or the fragments to recover.

The above considerations make it probable that the number of endemic *Charophyta* with a limited area will remain very low.

CHAPTER III. **Classification.**

§ 1. Historical. Up from the earliest epochs, when the species were placed among *Equisetum* and *Hippuris* (DALECHAMPS, 1587, p. 1070; BAUHIN, 1620, p. 25) on account of the more or less similar habit and habitat, till comparatively recent times, when they were considered by HY (1913, p. 4) as belonging to the *Bryophyta*,

the group was subjected to numerous alterations regarding its place in the Vegetable Kingdom, as has been extensively described by WILLDENOW (1805, p. 80), BISCHOFF (1828, p. 23), T. F. ALLEN (1888, p. 9), MIGULA (1897, p. 53), ROBINSON (1906, p. 251), and GROVES & BULLOCK WEBSTER (1920, p. 2). Some additional information may be taken from the synonymy on the division and the family (Taxonomical Part). It would therefore be superfluous to repeat the history here.

GROVES & BULLOCK WEBSTER, in part II of their splendid work "The British *Charophyta*" (1924, p. 72), have added a chapter on the palaeontology of the group, including a list of books and papers, to which I may refer for this subject.

§ 2. Subdivision. The subdivision of the *Charophyta* used in the present paper is mainly based on the opinions of JAMES GROVES (1924, 1935) which in their turn are mainly in accordance with those of ALEX. BRAUN (1835, 1849, 1868, 1882). In *Nitella*, the classification is based on the kind of branchlets in each whorl, the number of cells composing the dactyls, the comparative length of the dactyls, and the presence or absence of mucus around the fertile whorls. In *Tolypella*, the shape of the ultimate cell of the branchlets and rays, and the mode of furcation of the sterile branchlets form important characteristics for the subdivision. The genus *Chara* is mainly subdivided on account of the number of rows of stipulodes and on the disposition of the cortication of the stem and branchlets. The fact whether the plants are dioecious or monoecious is of great importance in all genera. The classification based on these particulars and the few alterations which were added by me, are to be found in the remarks to the genera of the Taxonomical Part.

It appears that, especially in the genus *Chara*, large and polymorphous species are not rare, e. g. *Chara australis*, *C. Braunii*, *C. fibrosa*, and *C. zeylanica*. In addition, BRAUN's species *Chara Benthamii*, *C. gymnopitys* and *C. flaccida* had to be combined as subspecies into one large and polymorphous species (*C. fibrosa*), since intermediate forms occur and since the constituent species are different in one single important character. In the present paper varieties have been distinguished in those cases, in which a number of more or less important characters were extant, and forms, when one characteristic of minor importance could be stated. To "var. typica" and "f. typica" are considered to belong the type specimen of the species or the variety respectively and the specimens which are not or hardly distinguishable from it.

In *Thallophyta* geographical particulars are, as a rule, less important for the delimitation of taxonomic units, owing to the easy mode of dispersal. On account of this, it will probably be more necessary in this group than in the *Cormophyta* to involve e. g. ecological features and experimental methods.

§ 3. Homologous variations. This phenomenon has come into prominence especially after VAVILOV's publication of the "Law of Homologous Series in Variation" (1922, p. 75), being elaborated by him and his school for cultivated plants belonging to the *Gramineae, Cucurbitaceae* and the *Leguminosae,* whereas DIELS (1932) did the same for the *Annonaceae.* For the *Thallophyta,* as far as I know, the attention was only drawn to this peculiarity for the *Fungi,* though the regularity in the participation of the characters in the *Charophyta* species is also obvious. This has given rise to the establishment of identic names for corresponding subdivisions in the same genus. As this is, however, in contradiction to the "International Rules" (Art. 61) some of them had to be changed.

With the aid of the above-cited characters used for the classification and some other ones, the tables IV—VII give a survey of the homologous subdivision in three of the genera best represented in our area.

In table IV (*Nitella*), both the sections *Homoeoclemae* and *Heteroclemae* (in Malaysia only 1 species) are subdivided into groups with one- to more-celled dactyls, and with dioecious and monoecious plants. In both of the latter groups we meet with species with aggregate and solitary gametangia, and in both a mucous cloud around the fertile whorls may be absent or present. However, whereas the section of the *Heteroclemae* has only one representative in our area, the section *Homoeoclemae* is very well represented. In the latter the series *Bicellulatae* has come to the richest display and the *Pluricellulatae* to the poorest, the only species of this series being only very recently detected. Furthermore, table IV shows that the dioecious species are less numerous than the monoecious. Finally I may add that in the Malaysian species of *Nitella* the base of the whorls is always sterile, *Nitella burmanica* and *N. polycarpa* excepted.

It would be very instructive to compare this table with one including all *Nitella* species. However, I have to refrain from such an attempt, as there is no recent monograph. Especially on comparing a complete conspectus with the distribution based on the zones of lati-

TABLE

Homologous variations

Plant	Gametangia (Mucus / Dactyls)	1-celled: Absent	1-celled: Present	1—2- or 1—3-celled: Absent	1—2- or 1—3-celled: Present
Dioecious	Aggregate	—	*mirabilis*	—	—
	Solitary	—	—	—	—
Monoecious	Aggregate	**acuminata*	—	—	—
	Solitary	—	—	*tuberculata*	**sumatrana*
Dioecious	Aggregate	—	—	—	—
	Solitary	—	—	—	—
Monoecious	Aggregate	—	—	—	—
	Solitary	—	—	—	—

[1]) Malaysian species denoted by an asterisk.

…T.

Nitella [1]).

2-celled		2—3-celled		2—6-celled		Sections
Absent	Present	Absent	Present	Absent	Present	
—	—	—	—	—	—	Homoeoclemae
flagelliformis	*dualis* *globulifera* *Annandalei*	—	*superba*	—	—	Homoeoclemae
**axillaris* **moniliformis* *burmanica* **furcata* **tumulosa*	—	**mucronata* *polycarpa* **microcarpa*	—	—	—	Homoeoclemae
**bipartita* **pseudoflabellata* *batrachosperma* *dictyosperma* *flagellifera* *patula* **oligospira*	**pseudoflabellata* *batrachosperma* *leptodactyla* *Wattii*	*tenuissima*	*elegans*	**Alleninda*	—	Homoeoclemae
—	—	—	—	—	—	Heteroclemae
—	—	—	—	—	—	Heteroclemae
—	—	—	—	—	—	Heteroclemae
—	*hyalina*	—	—	—	—	Heteroclemae

tude, it might be possible to prophesy which species — known or new — may be expected in a certain area.

Table V shows the parallel subdivision for *Tolypella*, and as nearly each of the groups has one representative in our area, the genus

TABLE V.

Homologous variations in *Tolypella* [1]).

Ultimate cell \ Plant	Dioecious	Monoecious
Conical	—	*prolifera*
Allantoid	*hispanica*	*glomerata*

TABLE VI.

Homologous variations in the HAPLOSTEPHANAE-ECORTICATAE of *Chara* [1]).

Plant	Gametangia \ Base of the whorls	Fertile	Sterile
Dioecious	Aggregate	**australis* *Wallichii*	—
	Solitary	—	**fulgens*
Monoecious	Aggregate	**corallina* *succincta*	**Braunii* *pashanii*
	Solitary	—	*nuda*

[1]) Malaysian species denoted by an asterisk.

TABLE VII.

Homologous variations in *Chara*[1]).

Branchlet-cortex	Stem-cortex / Plant / Gametangia	Haplostichous Dioecious	Haplostichous Monoecious	Diplostichous Dioecious	Diplostichous Monoecious	Triplostichous Dioecious	Triplostichous Monoecious	Sections
Absent	Geminate	—	—	—	*fibrosa *erythrogyna	—	—	Haplostephanae-Corticatae
Partially present (diplostichous)	Solitary	—	—	—	burmanica *hydropitys[2])	—	—	Haplostephanae-Corticatae
Absent	Geminate	—	—	—	—	—	—	Diplostephanae
	Solitary	—	—	—	Grovesii	—	Handae	Diplostephanae
Haplostichous	Geminate	canescens	—	—	—	—	—	Diplostephanae
	Solitary	—	—	—	—	—	—	Diplostephanae
Diplostichous	Geminate	—	—	—	contraria	—	—	Diplostephanae
	Solitary	—	—	—	vulgaris	—	*globularis delicatula	Diplostephanae
Triplostichous	Geminate	—	—	—	—	—	—	Diplostephanae
	Solitary	—	—	—	—	aspera infirma connivens	*inermis *brachypus *zeylanica	Diplostephanae

[1]) Malaysian species denoted by an asterisk.

[2]) *C. hydropitys* has sometimes a triplostichous stem-cortex,

may be considered fairly well represented. A peculiarity of the three species occurring in the area under discussion is that the sterile branchlets are all simple, whereas a number of species occurring in North-America have them furcate.

The *Chara* species without a cortex are united in table VI. Within this subsection from either point of view two groups are to be distinguished which are subdivided in the same way.

The corticated *Chara* species are classified in table VII, from which the parallelism in characters is clear. Moreover, it is obvious that dioecious species and those with geminate gametangia are relatively few in number. Aggregated gametangia are not to be found at all and the base of the whorls is always sterile. Table VI, in contradistinction to VII, shows a prominent number of species in which the gametangia are aggregated, the base of the whorls being fertile.

§ 4. Conclusions. Summarizing, we find the fact confirmed that a genus, or in general any group of species, has to be considered a population comprising a certain number of characters or in general of potentialities, of which each individual possesses a limited number only (LAM, 1938, p. 117). Not every combination of potentialities, however, produces a viable "new" species, which may be due to factors of which we know nothing. Therefore, it is possible that some of the empty partitions never will be or have never been filled up. In addition, one or more of the potentialities might have become latent for a longer or shorter period, whereas the circumstances (internal or external) by which they may be reactivated, are entirely unknown.

However, the morphological descriptions of the species only, even if accompanied by their geographical distribution and the variation of their characters provide an incomplete knowledge of the life cycles we try to classify. It is true, the work of classical taxonomists is, as VAVILOV (1940, p. 565) says, "basic biological work", but the nature of the species cannot be really understood by this kind of work only. "It is", and I am in full agreement with TURRILL's words, quoted as a motto at the heading of this paper, "only by a combination of all methods, herbarium or museum, library, laboratory, field and breeding, that there is any hope of obtaining satisfactory evidence on the nature and genesis of taxonomic units". This is true *a fortiori* for *Thallophyta*, and the hope may be expressed here that detailed ecological, cytological and genetical experiments may be carried out in order to check and eventually correct our present views.

CHAPTER IV. **Ecology.**

The study of the ecology of the *Charophyta* was only started in the last decennium. Especially the papers of STROEDE (1931, 1933) on the German lakes have thrown more light on this subject. In India, PAL (1932) has given some valuable data, whereas in Malaysia nothing has been done in this field of investigation. However, it must be added that valuable physical and chemical data on some of the lakes in Sumatra, Java and Bali were collected by the German Limnological Sunda Expedition in 1928 and described by RUTTNER (1931). It may have some use to discuss the ecological data which have come to my knowledge, as far as they concern the area under discussion. These data are drawn from the label annotations which were scanty and probably in some cases not very accurate either!

§ 1. Types of waters. Though it is, generally speaking, true that *Charophyta* are inhabitants of stagnant, shallow water, the following arrangement gives a number of additional places in which these plants are found in Malaysia.

A. *Stagnant fresh water, not drying up.* — Lakes, ponds, pools, stagnant ditches and moats. Waterholes in rivers and streams, jhils (a "depression below an old river bank", India, U. P.) and raos (torrent beds, India, U. P.). Caldera lakes. Bogs and swamps. Artificial water basins.

B. *Small amounts of fresh water, usually only present during a part of the year.* — Pools in rocks, road-side pools, road-side drains. Temporary rain puddles and hoof prints fitted with water. Kawah pools (pools in crater areas, Malay).

C. *Rice-fields (paddies).* — The fields may be in cultivation or fallow, the water being stagnant or having a hardly perceptible current.

D. *Running waters, moving slowly or with moderate velocity.* — Rivers, streams, canals, tributaries, flowing ditches, creeks, bays. Cataracts basin, rapids, springs.

E. *Brackish waters, stagnant or moving slowly.* — Estuaries, mudflats near the sea-shore, brackish pools, marine fishponds.

§ 2. Water-movements and air. It appears from § 1 that particularly group D, but to a smaller degree also group E, encompasses the species which are not restricted to stagnant water only (lentic environments or standing-water series; WELCH, 1935) or which do not occur in quiet places at all. From the latter group I do not know an example, but Malaysian (denoted by an asterisk) and Indian species that are found in running water (lotic environments) are the following:

**Nitella acuminata* var. *subglomerata, N. globulifera, N. Annandalei,* **N. pseudoflabellata* var. *mutila,* **N. oligospira* f. *indica,* **N. tumulosa,* **N. furcata* var. *Roxburghii,* **N. microcarpa, N. hyalina, Tolypella prolifera, T. hispanica, Chara Wallichii,* **C. Braunii* var. *Braunii* and *var. *Vieillardii, C. nuda,* **C. fibrosa, C. Grovesii, C. vulgaris, C. Handae, C. delicatula,* and **C. brachypus.*

As may be seen, the number of *Charophyta* occurring in running water is higher than would generally be expected. However, it must be added that the water motion is a continuous flow in a definite direction, the plants being not subjected to much disturbance. Therefore, the influence of mechanical action may be neglected. *Charophyta,* to my knowledge, are not able to withstand wave movements as surf, etc., which occasionally occur in the littoral zones of larger lakes, nor are they found in canals with much shipping-traffic or in localities where the outlet of factories spoils the water. Therefore in Lake Toba, for instance, *Charophyta* are only found in quiet bights.

On the other hand, moving water leads to a greater activity of the assimilation, as the supply of oxygen is facilitated, whereas at the same time more inorganic nutriment is supplied. *Charophyta* are adapted to live in stagnant water with a relatively low percentage of oxygen, the assimilative surface in contact with water being much enlarged by the many furcations and articulations.

§ 3. Depth and light. Papers frequently mention: "in shallow water", however, many *Charophyta* may have a wide vertical range. In depths from 2—8 metres occur: *Nitella acuminata, N. sumatrana, N. flagelliformis, Nitellopsis obtusa, Chara australis* var. *Vieillardii, C. corallina, C. hydropitys, C. contraria,* and *C. aspera.*

Nitella mucronata and *Chara zeylanica* were found at still greater depths, viz. at 10 and 12 metres respectively. The other *Charophyta* mentioned in the present paper are collected in the shallower water not deeper than 2 m. Here the bottom may sometimes be carpeted by a "cushion" of *Charophyta.*

The plants mentioned above are not restricted to these zones, but may occur occasionally at greater or at smaller depths, due to the fact that every species has its range of tolerance with regard to the intensity of light. Other factors are also of importance, e. g. a stronger movement in the upper layers of the water, the substances dissolved in it and the temperature, but, in my opinion, below the 2 m zone light plays the most important part.

Light intensity diminishes by reflection and by absorption; the

latter being dependent on depth and transparency of the water. Consequently, the intensity of photosynthesis decreases at greater depth. Floating leaves of higher aquatic plants living in the epilimnion may also impede or even prevent the growth of *Charophyta* at a certain depth. These effects were checked by MUKERJI (1932), who found that the *Charophyta* vegetation in Dal Lake (W. Himalaya) is found to a depth of 17 feet, whereas in the Manasbal Lake at the same altitude, but the water of which was 6—8 times clearer (judged with a photometer), the vegetation extends further down to a depth of about 25 feet. *Nitella acuminata, N. flagelliformis, N. hyalina, Nitellopsis obtusa* and *Chara globularis* are able to grow in very low intensities of light.

However, light influences not only the vertical distribution, but also the growth and reproduction. This is clearly shown by the investigations of KARLING (1924), who summarizes the literature concerning this point. KARLING has shown that a few hours of artificial illumination in addition to the daylight are sufficient to induce the development of antheridia and oogonia in mid- and late winter, whereas in nature the plant, with which the experiment was carried out, viz. *Chara globularis*, has (in N. America) ripe oospores from June to September. Moreover, growth under artificial illumination led to the lengthening of the internodes, shortening of the branchlets, etiolation, and a general spindling habit. The same conclusion was also obtained by the experiments of VOUK & BENZINGER (1929).

§ 4. Temperature and drought. The *Charophyta* occurring in the upper layers of deep waters are more exposed both to diurnal and seasonal fluctuations of temperature than those occurring in the lower zones.

In this regard the investigations of RUTTNER (1931, p. 229) on the surface temperature of Ranau Lamongan (E. Java) are of importance. The lake mentioned has an area of about 2 km², therefore the wind action is unimportant. The daily temperature amplitude was measured over a period of 17 successive days in the open water and in a community of *Hydrilla*, floating just below the surface at a distance of 15 m off the shore. The greatest amplitude in the open water was for one day 4°.6 (29°.2—33°.8) C. and in the *Hydrilla* community 11°.8 (28°.3—39°.1) C. Within the period mentioned the temperature in this community was for 3 days 39° C. or more, and for 11 days 35° C. or more.

It is well-known that some *Chara* species have a wide temperature range; e. g. *C. globularis* is recorded both from the hot springs in

Iceland and in Yellowstone Park and from ice water in the "north".

The seasonal fluctuations will be of minor importance since RUTTNER (*l. c.*, p. 403) has shown that in a number of Malaysian lakes the maximum contrast between bottom and surface temperatures was 5°.5 C. In small water basins the temperature affects also the evaporation, by which the concentration of dissolved substances is increased, whereas small pools may disappear altogether. This explains partly why some species have been found in all seasons and others only during a short period, as may be seen from table III. Therefore, in those tropical regions where the rainy season is short, the whole life-cycle of a Charophyte has to be completed within some few months. After the rainy season small pools, etc., will soon dry up and the *Charophyta* of these localities must be able to withstand a long period of drought. The parallelism between rainfall and seasonal distribution is discussed in Chapter II, § 3. It may be added that PAL (1932, p. 53) observed that the rapidly diminishing supply of water hastens the development of sexual organs.

The temperature also acts on the dissolving power of water for gases, as "the colder this is the richer is it in oxygen and carbonic acid, and the more favourable may be the conditions for nutrition and consequently for growth" (WARMING, 1925). In this respect the experiments of KARLING (1924) are of interest, as this author showed for *Chara globularis* that the temperature, within the minimum and maximum limits for vegetative growth, is apparently an indirect factor in determining the production and functional activity of antheridia and oogonia.

§ 5. Elevation. Though many *Charophyta* are recorded from waters occurring in the lowlands, the present investigation shows that a number of species are found in more elevated areas. This is not astonishing as, to a certain limit, rainfall increases with elevation. In

TABLE VIII.

	Tandjong Priok (0 m)	Batavia (7 m)	Mr Cornelis (20 m)	Pasar Minggoe (35 m)	Dèpok (95 m)	Bodjong-gede (148 m)	Buitenzorg (266 m)
mm rain/year	1670	1836	1951	2276	3262	3529	4281

this respect the data of BRAAK (1925, p. 172), reproduced in table VIII are of interest. The table enumerates the annual rainfall for a number of stations situated at an increasing elevation.

According to the altitude of the localities the following groups may be distinguished (0—100 m group omitted):

A. 100—300 m above sea-level. *Nitella acuminata, N. oligospira* f. *indica, N. tumulosa, N. microcarpa.*

B. 300—1,000 m above sea-level. *Nitella bipartita, Chara hydropitys, C. contraria, C. zeylanica.*

C. 1,000—2,000 m above sea-level. *Nitella pseudoflabellata, N. moniliformis, N. mucronata, N. oligospira* f. *javanica, Chara fulgens, C. Braunii, C. vulgaris, C. infirma.*

D. 2,000 m and more above sea-level. *Nitella Alleninda* (2,500 m), *Chara Braunii* var. *oahuensis* (2,000—2,400 m), *Nitellopsis sarcularis* and *Chara brachypus* (c. 2,000 m).

The few label annotations, however, are not sufficient to make conclusions about the occurrence at different altitudes. Whether some species are entirely restricted to a particular altitudinal zone, is not known. PAL (1932, p. 51) writes that *Chara nuda* and *C. Grovesii* never have been found in the lowlands and *C. Wallichii* and *C. hydropitys* never in the mountains.

MIGULA (1897, p. 87) asserts that the *Charophyta* of greater elevation were smaller and more slender than those of the lowlands. I deem it possible that the growth-form of Phanerogams has influenced this author to say so, since I did not see any difference in the species examined by me. This is, of course, plausible as land plants are more closely affected by orographic factors than aquatic ones. Water at great altitudes will be mainly influenced by insolation and temperature.

§ 6. A q u a t i c   c o m m u n i t y. *Charophyta* mainly grow in localities where no large aquatic plants occur. As was pointed out above, this is probably due to the interception of the light by the floating leaves of these plants. In the area under discussion were found the following *Phanerogamae*: *Potamogeton crispus, P. pectinatus, Najas minor, Hydrilla verticillata, Ceratophyllum demersum, Myriophyllum verticillatum*; *Hydropteridales*: *Marsilia* and *Azolla*; and *Thallophyta* with numerous representatives.

Very often *Charophyta* are overgrown with epiphytes, especially *Diatomeae* and *Cyanophyceae*, but at times the following genera of

Chlorophyceae (among others) may infest them: *Spirogyra, Chaetophora, Oedogonium, Coleochaete.*

§ 7. Cl-content of the water. Most species of *Charophyta* cited under groups A, B, C and D of § 1 (this Chapter), are restricted to fresh water only: they are *halophobous* species. Other ones, however, occur sometimes in the areas of group E, they are *euryhaline* species. As such are to be mentioned: *Nitella hyalina, Nitellopsis obtusa, Chara fibrosa* ssp. *gymnopitys* and ssp. *flaccida, C. hydropitys, C. globularis, C. contraria, C. aspera, C. connivens,* and *C. zeylanica.* In Malaysia no *stenohalinous* species are known, but in India *Chara canescens* is a representative of that group.

Quantitative estimations with regard to a *Charopyta* lake are only known from the lakes investigated by the German Limn. Sunda Exped. These data (cf. RUTTNER, 1931) show that the Cl-content of the water seldom exceeds 0.01 g/l, however, in lake Batoer it is 0.2 g per litre. In this lake *Chara brachypus* was found. In following REDEKE (1922, p. 330; 1936, p. 12), who, at the instigation of NAUMANN (1921, p. 4), projected a "Cl-spectrum", which was adopted by THIENEMANN c. s. (1925, p. 226), the water of this lake must be distinguished as *oligohaline* (0.1—1.0 g Cl/l). Quantitative data outside Malaysia are known for the island of Salsette (North of Bombay), where *Chara succincta* was collected in water with a Cl-content of 15.2 g/l, the water being therefore *polyhaline* (10.0—17.0 g Cl/l). For *Nitella hyalina* and *Chara zeylanica* occurring in the same island, no exact data are mentioned, but DIXIT states that they are collected in a "saltwater mudflat near the sea shore" and in "saline waters" respectively. SENIOR-WHITE (1926, p. 225) mentions the occurrence of *Chara zeylanica* in a drain in Ceylon having a Cl-content of 20.0 g/l, the water being *salt* (> 17.0 g Cl/l).

§ 8. Ca-content of the water. While MIGULA (1897, p. 91) states "Jedenfalls spielt aber der Kalkgehalt der Wässer in Bezug auf die Verbreitung der Charen gar keine Rolle", the investigations of STROEDE (1931, 1933) have shown that some species only grow in fresh water with a certain minimum content of calcium. *Nitellopsis obtusa, Chara delicatula* and *C. globularis,* mentioned in the present paper, were found in Germany in places where the water contained 15—25 mg CaO per litre. *Chara aspera* needs a minimum content of 47 mg/l, *C. vulgaris* of 55 mg/l, *C. contraria* and *Nitella mucronata* of 60 mg/l. As CaO-maximum STROEDE mentions for *Chara vulgaris* 243 mg/l.

Finally it must be added that the experiments of VOUK and

BENZINGER (1929) with *Chara globularis* led to the conclusion that "calcium is indispensable" for that species.

In addition, more attention has been drawn by various authors to the calcareous incrustation. Formerly this was only teleologically explained, viz. in this sense that incrustation would greatly add to the rigidity of the structure and that it would mitigate the influence of too intensive an insolation. However, VILHELM (1923, p. 173) has shown that it is possible to give a causal explanation. The incrustation is, namely, dependent on the factor light, which, in its turn, influences the intensity of the assimilation. The carbon dioxide contained in the calcium hydrogen carbonate, is seized by the assimilating *Charophyta*, whereas the $CaCO_3$ is excreted on their surfaces. Consequently, the quantity of this excretion is largely dependent on the light intensity.

Furthermore, the more flexible *Nitella* species, for which the incrustation would be more useful than for the corticated and more rigid *Chara* species, are usually less provided with calcium deposits. Moreover, one and the same species is in one locality incrustated and in another one not at all.

The frequently occurring annular incrustation needs further investigation.

§ 9. Fe-content of the water. USPENSKI (1927, p. 48) gives some data with regard to this subject. *Cladophora fracta* and *Oedogonium capillare* grow luxuriantly in water with 0.2 mg Fe_2O_3 per litre, but they collapsed when the Fe_2O_3 content was raised to 0.8 mg/l, under which condition, however, a *Chara* species appeared. The same author states (*l. c.*, p. 88) that *Chara contraria* grows in ponds with 0.2 mg Fe_2O_3 per l, but a *Nitella* species is said to be able to withstand higher contents. In Malaysia RUTTNER (*l. c.*, p. 440) could only state a trace of iron in the lakes Toba, Ranau (both Sum.), Bratan and Batoer (both Bali).

STROEDE (1933, p. 217) has measured the iron-content of some waters in which *Charophyta* occur. His results for the German species, distributed also in the area under discussion, are: *Tolypella nidifica* and *Chara contraria* occur in Fe-oligotrophic water (0.0—0.25 mg Fe_2O_3/l), whereas *Nitella mucronata, Nitellopsis obtusa, Chara delicatula, C. aspera, C. vulgaris* and *C. globularis* are also found in Fe-mesotrophic waters (0.25—1.0 mg Fe_2O_3/l).

§ 10. Organic substances in water. MIGULA (1897, p. 91) already suggested that this factor could be of some importance. STROEDE (*l. c.*, p. 218) has shown that *Tolypella nidifica* and *Nitellopsis obtusa*

do not thrive well in waters with much organic substances, but that they prefer waters with a $KMnO_4$-consumption of less than 10 mg per litre. *Chara delicatula*, *C. vulgaris* and *C. globularis* prefer waters which are oligo- and mesotrophic with regard to the organic substances (10—25 and 25—75 mg $KMnO_4$/l).

§ 11. pH. All data known about hydrogen-ion concentration of the Malaysian inland waters are collected by the German Limnological Sunda Exped. The data occurring on the labels of the specimens examined by me are united in table IX, though not all of these exactly agree with those mentioned in the paper of RUTTNER.

It follows from table IX that the hydrogen numbers range from moderately low (water acid; pH 5.5) to fairly high (water alkaline; pH 8.7). This was to be expected on account of the considerable quantities of lime with which some of the species are incrustated. However, this incrustation is in *Nitella* by no means as pronounced as in *Chara*. The data of the table are in agreement herewith: in *Nitella* only one value out of four well exceeds the neutral point, whereas in *Chara* only two values out of six are slightly below that point. Although this suggests that most of the *Nitella* species mentioned are moderately to weakly acidophilous plants and those of *Chara* neutrophilous and basophilous, the data are too few to allow generalization. Moreover, I do not know whether the H-ion concentration of the different waters was measured under the same conditions (e. g. hour, depth, etc.).

The pH factor in relation to Burmese *Charophyta* was investigated by PAL (1932, p. 55). The study of this author led him to conclude: "that high pH is favourable to the growth of Charophytes, while a pH below a certain limit (about 8.0) inhibits their growth". This conclusion is not in contradistinction to the data here given, but a minimum pH of 8.0 is certainly too high for the Malaysian species. As to the alkalinity and the conductivity these data are too insufficient to draw any final conclusion.

§ 12. Bottom and H_2S. It is a well-known fact that *Charophyta* occur mostly on a soft muddy bottom and so it is in Malaysia. However, some species are found growing on clay and on fine sand, e. g. *Nitella acuminata*, *Chara contraria* and *C. brachypus*. *Nitella batrachosperma* was collected in a pool, attached to a mass of decaying filamentous algae.

As far as I know, nothing is known about the chemical composition of the mud in which the Malaysian species have been found to grow. This composition must be of importance, since VOUK and BENZINGER

TABLE IX.

Species / Physical factors	Surface temp., °C.	pH	Alkalinity	Conductivity	Locality
Nitella					
3. — *sumatrana*	25—27	8.3	1.56	$1.33.10^{-4}$	Lake Toba, Porsea basin (Sum.)
11. — *pseudoflabellata* var. *mutila*	27.5	5.5		$0.06.10^{-4}$	Pool on moor of Hoetagindjang (Sum.)
22. — *furcata* var. *Zollingeri*	25—33	6.5		$0.23.10^{-4}$	Pond at border of Tjiliwoeng (Java)
24. — *mucronata* var. *pseudo-graciliformis*	22.1	6.8	0.16		Danaubratan, caldera lake near Batoeriti (Bali)
Chara					
1. — *australis* var. *Vieillardii* f. *simplicissima*	25—27	8.3	1.56	$1.33.10^{-4}$	Lake Toba, Porsea basin (Sum.)
4. — *fulgens*	22.1	6.8	0.16		Danaubratan, caldera lake near Batoeriti (Bali)
5. — *Braunii* var. *Braunii* f. *sumatrensis*	22.3	7.5	2.80		Spring marsh near Lake Toba (Sum.)
— *Braunii* var. *oahuensis* f. *leptocoronulata*	16.1	6.7	0.48		Spring basin on Dijèng plateau (Java)
24. — *brachypus*	22.7	8.5	5.80		Danau Batoer, caldera lake on G. Batoer (Bali)
25. — *zeylanica* f. *armata*	27—28	8.7	1.60		Lake Toba, Porsea basin (Sum.)

(1929) have shown that the rhizoids of *Charophyta* represent the main organs of absorption of nutritive materials, whereas the surface of the thallus has in this respect a subordinate function. Further investigation concerning this point would, in my opinion, be desirable.

Most *Charophyta* have a more or less disagreeable smell of sulphuretted hydrogen (very well expressed in the American popular names: "mush grass" and "skunk grass"). The mud of the stagnant pools has retained great quantities of H_2S — according to STROEDE (1931, p. 71; 1933, p. 225) more than 50 mg per litre — mainly produced by anaerobic heterotrophous reduction of sulphates (e. g. *Microspira desulfuricans*) and, moreover, by putrefaction of proteins, for the greater part furnished by decaying *Charophyta* themselves. Parallel with the presence of hydrogen sulphide in the mud and the hypolimnion runs the deficit of oxygen, since the H_2S is oxygenized. When the bottom is ferruginous, iron sulphide is formed, by which the mud is rendered black. The epilimnion is the region of photosynthesis and therefore oxygen is present (BAAS BECKING, 1934, p. 166). However, in times, when assimilation is diminished and the reduction in the hypolimnion becomes more intensive, the oxygen may be substituted by H_2S. Even then, *Charophyta* are able to live under these circumstances, but STROEDE (*l. c.*) has shown for *Nitella mucronata* and *Chara globularis* that these species are not able to endure these conditions longer than some weeks. The data of the water of the pool on the moor of Hoetagindjang (cf. table IX), viz. low pH and few mineral salts, indicate that it was entirely in a "hypolimnic" phase during the time of investigation. This must occasionally be the case in other localities, c.f. e. g. *Nitella pseudoflabellata* var. *mutila* and *Chara fibrosa* ssp. *gymnopitys*, which were collected in "brown peaty water". The *Charophyta* (and other aquatic vegetation) were not able to maintain the oxygen pressure and died when this had reached a certain minimum. In addition, it must be noted that STROEDE (*l. c.*) has shown that for *Charophyta* the presence of H_2S in the mud is not essential.

CHAPTER V. **Economy.**

§ 1. Vernacular names. In Malaysia, just as in other parts of the world, the *Charophyta* are of little economic importance. This is certainly the reason why vernacular names are relatively rare. As such are in use, according to the label annotations: limoet (Bat.,

Daj.), loemoet (Alf., Min., Balin., Jav., Mal.), gagang (Jav.), ganggang (Jav.), ganggeng (Jav., Mal.) and gonggang (Mal.).

The same names, however, are also given by the natives to other submerged aquatic plants, e. g. *Musci*; *Najas falciculata*; *Hydrilla verticillata*; *Ceratophyllum demersum* and *C. submersum*; *Utricularia flexuosa*; cf. BACKER (1911), DE CLERCQ & PULLE (1927), HEYNE (1927). The economic use of these plants, mentioned especially in the paper of the first-named author, are most probably also bearing upon the *Charophyta*.

§ 2. Fish-culture. In the tropics it may often be observed that already in the forenoon the stagnant waters, in which *Charophyta* and other submerged plants grow, are in a state of supersaturation with O_2, shown by the rise of oxygen bubbles to the surface (cf. RUTTNER, *l. c.*, pp. 235, 417); the converse activity, i. e. the oxygen consumption for respiration, being less intensive. As the amount of oxygen dissolved in water is raised by the photosynthesis of green plants, these might for that reason be recommended for use in fish-cultures.

§ 3. Purification of water. The water in which the *Charophyta* grow is always extremely clear. This may at least partly be ascribed to the fact that *Charophyta* are able to purify the water by retaining mud particles between the whorls of their branchlets.

§ 4. Food. A great number of insects, crustaceans, snails and other organisms, take shelter in the dense masses of *Charophyta* and/or feed on them, thus providing a rich supply of food for fishes at the same time. In addition, it must be stated that some fishes make nests among *Charophyta*.

According to BACKER (*l. c.*, p. 514), *Najas tenuifolia* (limoet siarang) is used at Lake Toba as a food for hogs. This lake has a rich *Charophyta* flora and it is very well possible that *Charophyta* are also used for this purpose. Dr BACKER was so kind as to confirm this.

In this connection, it may be of interest that MACATEE (1915) has found that all parts of various *Charophyta* are eaten by 14 species of ducks occurring in North Carolina (U.S.A.). More than 1,100 root-bulbils were observed in the stomach of one single goldeneye and more than 1,500 in that of a pintail. Therefore he recommends *Charophyta* as food for wild duck. In Malaysia too, I think, it would furnish a cheap and readily accessible food, and might therefore be introduced in native breedings of ducks.

§ 5. Manure. FILARSZKY (1934) reproduces a photograph made by Prof. A. THIENEMANN, representing a heap of *Charophyta* at the

bank of Lake Batoer, Kedisan, Bali. These were dredged by the natives, who look in it for snails which are used as a duck's food.

TABLE X.

Chemical analysis of *Chara hispida* dried in air.

Constituent	Percentage	Remarks
Water	5.25	In the ashes for every 1,000 parts 161 are lime and 1.57 phosphoric anhydride.
Pure ashes and silica	47.00	
Crude fat	1.80	
Crude protein	4.37	
Crude cellulose	7.64	
Other carbohydrates	33.94	

TABLE XI.

Chemical analysis of *Chara fibrosa* dried in air and sand-free.

Constituent	Percentage
Ash	41.22
Crude protein (N × 6.25)	4.50
Ether extract	0.76
Crude fiber	9.32
Pentosans	4.70
Nitrogen-free extract	39.50

Constituent of the ash	Percentage
Silica, SiO_2	0.83
Ferric oxide, Fe_2O_3	0.06
Aluminium oxide, Al_2O_3	0.81
Manganomanganic oxide, Mn_3O_4	0.08
Calcium oxide, CaO	37.82
Magnesium oxide, MgO	1.19
Sodium oxide, Na_2O	0.35
Potassium oxide, K_2O	0.58
Chloride, Cl	0.29
Carbonate, CO_3	39.00
Total sulphur, S	0.27
Total phosphorus, P	0.06

Prof. THIENEMANN kindly informed me of his opinion that the *Charophyta* were afterwards spread upon the land as manure. This is also done in several countries in Europe, cf. PROSPER (1910, p. 197) and WASMUND (1933, p. 436).

The importance of using the decayed *Charophyta* for manure or especially for correcting the acidity of soils, may appear from the subjoined analyses of *Charophyta*. In literature mostly the nearly "classical" data of PROSPER (table X) are quoted, but in 1929 SCHUETTE & ALDER have published another analysis, which, however, does not differ much (table XI) from that of PROSPER.

It follows from these tables that the content of calcium oxide and carbonate is very high and it requires no further comment that *Charophyta* debris must be of great importance as lime-manure.

In addition, it must be noted that by the death and decay of *Charophyta* enormous banks are formed at the bottom of the waters from which these plants are not collected for agricultural purposes. SCHUETTE & ALDER (*l. c.*, p. 145) have determined from these analyses that in Green Lake, Wisconsin, the annual growth requirements of *Chara* are for calcium 397 metric tons and for carbon in terms of carbon dioxyde 427 metric tons. To this lake, with an area of c. 30 square kilometres and an average depth of c. 50 metres, every year 993 metric tons of calcium carbonate are returned. These data show that in the numerous lakes of Malaysia considerable masses of this *Chara* marl are possibly still available to be utilized.

At the same time, a minor part is played by the decaying *Charophyta* which are accumulated at the bottom of waters, and by which action the bottom is raised. Therefore the plants may be useful in land reclamation.

§ 6. Polishing-paste. DALECHAMPS, in "Historia Generalis Plantarum", I (1587, p. 1070), cites that the inhabitants of Lyon, France, made use of a plant with the popular name "*Chara*" to polish plates and other domestic utensils. Cf. also DUCHESNE (1836, p. 5).

§ 7. Mud-bathing. PROSPER (1910, p. 201) writes that in Spain in a pool people have bathed, "attributing the cure to their maladies to the action of the deposit of saltpetre on the banks, the 'saltpetre' being the white masses of dry *Chara* which surround the pool". Cf. also WASMUND (1933, p. 508).

§ 8. Therapy. In connection with the foregoing, it may be added that WASMUND (*l. c.*, p. 516) writes that *Charophyta* are sold in

Germany as chemicals, which, when taken, should prevent a number of diseases. It seems not impossible that *Charophyta* in some form are sold in Malaysian druggist's shops.

§ 9. Clarification of sugar. WATT (1899, II, p. 263) quotes ATKINSON, who should state that *Chara involucrata* is used in Bengal to clarify sugar, but WATT has never seen *Chara* so employed. Now ROXBURGH (1832, p. 752) states for *Hydrilla verticillata* that "the Bruhmapoor sugar refiners use this herb, while moist, to cover the surface of their sugars, as clay is used in the West India Islands, and in two or three days the operation is finished exceedingly well". In Malaysia *Charophyta* and other aquatic plants are not reported to be used in the sugar industry, as far as my knowledge goes.

§ 10. Insects. In some parts of Java a plant, named ganggeng or ganggang, is used to lure noxious insects, especially the nauseous-smelling bug, *Leptocorisa varicornis* (walang sangit, Jav.). Bushes of this plant — according to BACKER (*l. c.*, p. 504) *Ceratophyllum* species, but probably also other submerged plants, including *Charophyta*, are in use as they bear the same vernacular name — are attached to a stick which is placed in the rice-fields. The walang sangit then alights upon it and may thus be catched. VAN HEURN (1923, p. 24) is of the opinion that this method does not give satisfactory results.

Special attention must be drawn to the pathology of the imagines of *Diptera*, which show a pronounced preference for certain breeding places. WASMUND (*l. c.*, p. 517) states that species of *Tabanidae*, horse-flies, bred in the heaps of *Charophyta* at the bank of Lake Plön, Germany.

More extensive is the literature on the breeding places of mosquito larvae, which occur in water characterized by certain physical conditions. RUSSELL & BAISAS (1934, p. 298) give a list of the chief types of breeding places of Philippine *Anopheles* larvae. These habitats are nearly the same as for the *Charophyta*, as may appear by comparing the statement of these authors with that in Chapter IV, § 1. KING & DEL ROSARIO (1935, p. 334) state that breeding of *Anopheles* larvae is practically always associated with some kind of aquatic vegetation, usually algae. They cite, among others, a "*Chara*-like plant", which, however, is no Charophyte at all, but a plant belonging to the *Hydrocharitaceae*.

Although the agreement of habitats is very striking, a number of authors have stated that larvae of mosquitoes have never been found in localities where these plants occur. CABALLERO (1919) was the first

who observed this phenomenon, which was later on partly confirmed, but also partly denied after the experiments of SWELLENGREBEL in Holland (1924). For a review of the literature up to 1931, I may refer to STROEDE (1931, p. 88). The theory of CABALLERO was that *Chara vulgaris*, with which this author experimented in Barcelona, produces toxic substances which spread through the water and which were lethal to the larvae of mosquitoes.

In tropical countries the problem was first studied by BLOW (1924, p. 252; 1927, p. 46) in Madagascar (not mentioned by STROEDE). This author came to the conclusion that not the *Charophyta* themselves possess larvicidal properties, but some other substances occurring in the localities of these plants. Moreover, dilute solutions of glucoside from dried *Chara zeylanica* took no effect. *Nitella furcata* var. *Roxburghii, Chara fibrosa* ssp. *gymnopitys* and *C. zeylanica* appear to keep the water quite free of the larvae of *Theobaldia annulata, Culex pipiens,* and *Anopheles maculipennis.*

BUHÔT (1927) experimented with *Nitella phauloteles* and various species of mosquitoes, viz. *Stegomyia fasciata, Culex fatigans,* and *Anopheles nyssorhynchus.* "All gave the same and pleasing results, not laying their eggs upon the surface of the water in the aquarium where the *Nitella* grew". In addition, this author showed that water in which this *Nitella* grew, had no toxical activity on rats, fish and men.

In Burma, PAL (1932) experimented with *Nitella acuminata, N. oligospira* and *Chara fibrosa* ssp. *gymnopitys* and the mosquito *Culex fatigans.* Neither species proved to have any lethal effect on the insects. In nature, however, ponds containing mosquito larvae never contain *Charophyta,* and conversely. PAL arrives at the conclusion that this is due to the occurrence of larvae of *Libellulidae* (dragon flies), which have a greenish tinge or some other protective camouflage. They watch for prey, e. g. mosquito larvae, which often occur between the branchlets of the *Charophyta.* "This would account satisfactorily for the absence of mosquito larvae from waters containing *Charophyta.*"

Summarizing all these experiments, I tend to the opinion that the habitats of *Charophyta* are no favourable breeding places for mosquitoes. The matter is important enough to justify accurate experiments on a larger scale. These experiments must be preceded by exact analyses of the physical and chemical characteristics of the waters in which the *Charophyta* occur, in the way as was started by the German Limnol. Sunda Expedition. For the Philippine mosquito

breeding places such data are available by the experiments of several investigators, cf. DE JESUS (1936), who summarized them. Of these authors I wish to cite SENIOR-WHITE (1926), who investigated the chemical factors of Ceylon breeding places, but also studied in this connection the algal distribution. His data are of special interest as they are well comparable with those mentioned in the present and in the foregoing chapters. SENIOR-WHITE found that mosquito larvae in general only occur at a hydrogen number varying between 5.8 and 8.6, and in waters with a conductivity, varying between 62 and 922 ($\times 10^6$), measured at 25° C. Remarkably enough, this author found that mosquito larvae do not appear to be liable to supersaturation of the water, as fish do; *Anopheles maculatus* was still found in water with 14.84 mg oxygen per litre (the minimum lies at 0.87 mg/l). This state of supersaturation frequently occurs in the stagnant waters, where dense masses of *Charophyta* are found to grow. As is pointed out in § 2, oxygen is formed by photosynthesis and the water may sometimes become highly alkaline caused by the CO_2 consumption by photosynthesis. This is the reason why $CaCO_3$ may be precipitated. In connection with this, SENIOR-WHITE (*l. c.*, p. 233) mentions an important cause of larval mortality. Larvae of *Anopheles listoni* died when the pH under the above mentioned conditions rose to 8.6 and they were found covered by spherical bodies, with a dark centre and a broad translucent edge. What where thought to be the spores of a fungus, appeared to be sphaerocrystals of calcium carbonate. Though the larvae of mosquitoes are surface dwellers, I deem it very well possible that this is another cause for the absence of mosquito larvae from waters in which *Charophyta* are abundant.

The same author (*l. c.*, p. 225) also studied the distribution of algae with regard to the occurrence of mosquitoes. Two *Charophyta* are cited: *Nitella mucronata*, occurring in a tank (pH 6.5—6.6; conductivity 2.00—3.89 $\times 10^{-4}$; oxygen content 2.91—5.64 mg/l), appeared to have nothing to do with the feeding habits of the larvae; and *Chara zeylanica* found in a shallow pool (pH 7.6; conductivity $10.43 \cdot 10^{-4}$), with numerous *Odonata* larvae but only a very few *Culex* larvae. In a drain the same *Chara* species was found (pH 8.1; conductivity $111.91 \cdot 10^{-4}$; c. 3.3 % NaCl), and larvae of *Culex* were more numerous. SENIOR-WHITE considered these data too extreme to draw any conclusions though he tends to a feeding association of certain mosquitoes, mainly *Anophelines*, with certain algae, on the presence of

which that of the mosquitoes probably depends. These data as a whole, agree very well with those cited in table IX.

These few words on this important problem may suffice to show that the end is far from being attained. Definite conclusions on the toxicology of some *Charophyta* species cannot be drawn, but possibly an intensive study of the physico-chemical conditions of their localities may throw some more light on the solution of the malaria-problem.

CHAPTER VI. **Bibliography.**

(The references to the literature made in the Introduction and in the General Part are to be found here; in addition, those papers concerning the Taxonomical Part are enumerated here, which have not been cited at the heading of the species).

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TAXONOMICAL PART

CHAROPHYTA

Divisio CHAROPHYTA MIGULA, Die Charac., 1897, p. 94; DE WILDEMAN, Alg. Fl. Buitenz., 1900, p. 371; GROVES & BULLOCK WEBSTER, Brit. Charoph. 1, 1920, p. 4; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 412 — *Chareae* BISCHOFF, Krypt. Gew. Deutschl. Schweiz, 1, 1828, p. 24 — *Characeae* SACHS, Lehrb. Bot., ed. 1, 1868, p. 258; T. F. ALLEN, Charac. America 1, 1888, p. 7 — *Charales* OLTMANNS, Morphol. Biol. Alg. 1, ed. 2, 1922, p. 433; DANGEARD, Traité d'Alg., 1923, p. 208.

Subaquatic cell-cryptogams with numerous chloroplasts. Vegetative parts consisting of long internodal cells and short nodal ones, forming the stem and the laterals of limited growth, styled branchlets. These branchlets always produced in whorls originating on the stem-nodes and bearing the gametangia. Sexual reproduction by means of biflagellate spiral-shaped spermatozoids formed in spherical antheridia, and by means of an ovum formed within the oogonium, which is enveloped in five spirally arranged cells. Germination of zygote giving rise to a protonema, from which the mature plant sprouts as a lateral branch. Asexual reproduction lacking. Vegetative reproduction by means of secondary protonemata, starch-bulbils and fragmentation.

Distribution. About 200 species in fresh and brackish water in all parts of the world.

CHARACEAE

Familia CHARACEAE L. C. RICHARD ap. HUMBOLDT & BONPLAND, Nov. gen. spec. Plant. 1, 1815, p. 38; AGARDH, Syst. Alg., 1824, p. XXVII; GRIFFITH, Not. Plant. Asiat., 1849, p. 275; BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10, 1849, p. 5; KUETZING, Spec. Alg., 1849, p. 513; ZOLLINGER, Syst. Verz. 1, 1854, p. 4 (*nom. tant.*); WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 8; BRAUN in Monatsb. Kön. Akad. Wiss. Berlin f. 1867, p. 796, 1868 (*nom. tant.*); VON LEONHARDI in Lotos 13, 1863, repr. p. 9 (*nom. tant.*); id. in Verh. naturf. Ver. Brünn 2, 1864, repr. p. 36 (*nom. tant.*); BRAUN in COHN, Krypt. Fl. Schles. 1, 1876,

p. 369; NORDSTEDT in Symb. Soc. Physiogr. Lund., 1878, p. 23 (*nom. tant.*); BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 26 (*nom. tant.*); NORDSTEDT in Forschungsr. S.M.S. "Gazelle", 4. Th. Bot., 1889, p. 6 (*nom. tant.*); MIGULA, Die Charac., 1897, p. 94; DE WILDEMAN, Alg. Fl. Buitenz., 1900, p. 372; H. & J. GROVES in URBAN, Symb. Antill. 7, 1911, p. 30; MERRILL, Spec. Blancoan., 1918, p. 39; RIDLEY in Journ. Straits Branch R. A. Soc. 80, 1919, p. 162; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 412; FRITSCH, Struct. and repr. Alg. 1, 1935, p. 447 — sub *Equisetum* a. o. BAUHIN, Prodr. Theatri Bot., 1620, p. 25 — sub *Phanerogamae* sub *Monoecia Monandria* a. o. SCHREBER ex LINNAEUS, Gen. Plant., 1789, p. 619; PERSOON, Syn. Plant. 2, 1807, p. 530 — ibid. sub *Monandria Monogynia* a. o. WILLDENOW, Fl. Berol. Prodr., 1787 — ibid. sub *Monandria Digynia* a. o. BAUMGARTEN, Fl. Lips., 1790, p. 3 — ibid. sub *Monandria Polygynia* a. o. PURSH, Fl. Amer. sept., 1814, p. 4 — sub *Najas, Ceratophyllum* a. o. A. L. DE JUSSIEU, Gen. Plant., 1789, p. 18; ADANSON, Fam. Plant. 2, 1763, p. 537; REICHENBACH, Fl. Germ. Excurs. 1, 1839, p. 147 — *Gyrophykea* WALLROTH, Fl. Crypt. Germ., 1833, p. 100 — *Chareae* KUETZING, Phyc. Gen., 1843, p. 313; id., Spec. Alg., 1849, p. 513 — sub *Bryophyta* sub fam. *Characeae* HY in Bull. Soc. bot. France 60, 1913, Mém. 26, p. 4 — Ordo *Charales* FRITSCH, Struct. and repr. Alg. 1, 1935, p. 447.

Same characters as the division.

Key to the tribes.

1a. Cells of the coronula in two superimposed rows of five cells each . . . . I. NITELLEAE

b. Cells of the coronula in one single row of five cells . . . II. CHAREAE

I. NITELLEAE GANT. em. VON LEONH.

Tribus NITELLEAE GANTERER Oesterr. Char., 1847, p. 8, *pro parte*; VON LEONHARDI in Lotos 13, 1863, repr. p. 9; id. in Verh. naturf. Ver. Brünn 2, 1864, repr. p. 36; H. & J. GROVES in URBAN, Symb. Antill. 7, 1911, p. 30; HY in Bull. Soc. bot. France 60, 1913, Mém. 26, p. 5; GROVES & BULLOCK WEBSTER, Brit. Charoph. 1, 1920, p. 95; GROVES in Journ. Linn. Soc., Bot., 1924, p. 360; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 426; PAL in Journ. Linn. Soc., Bot., 49, 1932, p. 64; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 40; ZANEVELD in Blumea 3, 1939, p. 377 — Gen. *Nitella* AGARDH, Syst. Alg. 1824, p. XXVII, *p.p.* A. BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10,

1849, p. 12; id. in HOOKER's Journ. Bot. 1, 1849, pp. 195, 292; id., Consp. syst. Charac. europ., 1867, p. 1; id. in Monatsb. Kön. Akad. Wiss. Berlin f. 1867, p. 796, 1868 — *Charae epigynae* A. BRAUN in Ann. Sci. Nat., sér. 2, 1, 1834, p. 350; id. in Flora 18, 1835, pp. 12, 49; id. in Linnaea 17, 1843, p. 113 — Fam. *Nitelleae* A. BRAUN in COHN, Krypt. Fl. Schles. 1, 1876, pp. 368, 395; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 8; T. F. ALLEN, Charac. America 1, 1888, p. 38; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 592 — Subfam. *Nitelleae* A. BRAUN ap. MIGULA, Die Charac., 1897, p. 94; ROBINSON in Bull. New York Bot. Gard., 1906, p. 253.

Plants usually not incrusted and then translucent green coloured. *Stem* and *branchlets* entirely without cortical cells. *Branches* similar to the main stem, two or more at a stem-node, originating in the axils of the whorls of branchlets. *Branchlets* usually furcate with one-celled rays, except the ultimate ray (dactyl) which may be more-celled. Cells of the *coronula* in two superimposed rows of five cells each.

Key to the genera.

1a. Antheridia terminal in the furcations of the branchlets; oogonia lateral; oospores elliptic in transverse section . . . . **1. Nitella**
b. Antheridia and oogonia lateral at the branchlet-nodes; oospores terete in transverse section . . . . **2. Tolypella**

1. NITELLA AG. em. A.BR.

Genus NITELLA AGARDH, Syst. Alg., 1824, p. XXVII, *pro parte*; KUETZING, Phyc. Gen., 1843, p. 318, *pro parte*; WALLMAN in Act. Soc. Linn. Bordeaux 1856, p. 8, *pro parte*; VON LEONHARDI in Lotos 13, 1863, p. 69 (repr. p. 9); id. in Verh. naturf. Ver. Brünn 2, 1864, repr. p. 36; BRAUN in COHN, Krypt. Fl. Schles. 1, 1876, p. 395; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 28; T. F. ALLEN, Charac. America 1, 1888, p. 38; MIGULA, Die Charac., 1897, p. 95; DE WILDEMAN, Alg. Fl. Buitenz., 1900, p. 374; RIDLEY in Journ. Straits Branch R. A. Soc., 1919, p. 163; GROVES & BULLOCK WEBSTER, Brit. Charoph. 1, 1920, p. 95; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 360; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 592; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 426; PAL in Journ. Linn. Soc., Bot., 49, p. 66; GROVES & ALLEN in Journ. Roy. Soc. Queensl. 46, 1935, p. 40; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S., 1, 1937, p. 2 — *Chara* sect. *Nitella* (AG.) RUPRECHT in Beitr. Pfl. Russ. Reich.

3, 1845, p. 7 — *Nitella* sect. *Furcatae* A. BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10, 1849, p. 6 — *Nitella* subgen. *Nitella* A. BRAUN in HOOKER'S Journ. Bot. 1, 1849, pp. 195, 292 — *Nitella* sect. *Ebracteatae* WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, pp. 12, 14 — *Nitella* subgen. *Eunitella* A. BRAUN, Consp. syst. Charac. europ., 1867, p. 1; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 796, 1868.

Branches usually two at a stem-node, opposite. *Branchlets* once or more times furcate with more or less equal rays; fertile branchlets frequently contracted into heads. ♂ and ♀ *gametangia* usually sessile, solitary or aggregated, generally not produced at the base of the branchlet-whorls. *Antheridia* terminal, between the furcations of the branchlets, replacing the apical cell of a primary ray. *Oogonia* lateral at the branchlet-nodes, in the monoecious species just below the antheridia, arising from the basal node-cell of the antheridium or of the ray occupying the same place, thus representing a ray of higher order. *Oospores* laterally compressed, hence elliptic in transverse section.

Remarks. I subdivided the genus mainly in accordance with J. GROVES, whose classification was published after his death by G. O. ALLEN (1935, p. 49) and was based on the papers of BRAUN and NORDSTEDT. However, I propose to unite the plants with indifferently 2—3-celled dactyls into a new series of the *Arthrodactylae*, named *Heterocellulatae*. This series has to be inserted between the *Bicellulatae*, with the dactyls strictly 2-celled and the *Pluricellulatae* with the dactyls indifferently 2—6-celled. The classification here followed may be learned from the following review.

I. Sect. *Homoeoclemae*
- I. Subsect. *Anarthrodactylae*
- II. ,, *Heterodactylae*
- III. ,, *Arthrodactylae*
  - 1. Series *Bicellulatae*
  - 2. ,, *Heterocellulatae*
  - 3. ,, *Pluricellulatae*

II. Sect. *Heteroclemae*

Distribution. More than one hundred species in fresh and brackish water, in all parts of the world.

Key to the sections.

1a. Branchlets of each whorl nearly uniform and in a single row . . . . I. HOMOEOCLEMAE

b. Branchlets of each whorl of two distinct kinds and in 2—3 rows . . . . II. HETEROCLEMAE

Key to the species and varieties [1]

1a. Branchlets of each whorl in a single row and more or less equal (Homoeoclemae) 2
b. Branchlets of each whorl in more than one row and of two distinct kinds (Heteroclemae) . . . . 31. *N. hyalina*
2a. Dactyls (ultimate rays) strictly one-celled (Anarthrodactylae) . 3
b. Dactyls (ultimate rays) more-celled 5
3a. Plant dioecious; gametangia stalked . . . . 1. *N. mirabilis*
b. Plant monoecious; gametangia sessile 4
4a. Dactyls of sterile branchlets up to 500 μ long **2a. N. acuminata** var. **Bélangeri**
b. Dactyls of sterile branchlets longer than 650 μ . . . . **2b. N. acuminata** var. **subglomerata**
5a. Dactyls indifferently 1—2- or 1—3-celled (Heterodactylae) . . 6
b. Dactyls 2- or more-celled (Arthrodactylae) 7
6a. Sterile and fertile branchlets 1—2 times furcate; dactyls indifferently 1—2-celled; oospore membrane granulate . . . . **3. N. sumatrana**
b. Sterile and fertile branchlets 2—3 times furcate; dactyls indifferently 1—3-celled; oospore membrane tuberculate . . . . 4. *N. tuberculata*
7a. Dactyls strictly 2-celled (Bicellulatae) 8
b. Dactyls 2—3- or 2—5-celled 31
8a. Plant dioecious; dactyls elongated 9
b. Plant monoecious; dactyls elongated or abbreviated 12
9a. Branchlets 3—5 times furcate; dactyls 1—4 10
b. Branchlets up to 3 times furcate; dactyls 4—6 11
10a. Fertile whorls not enveloped in mucus; ripe oospores 300—350 μ long . . . . 5. *N. flagelliformis*
b. Fertile whorls enveloped in dense mucus; ripe oospores 160—260 μ long . . . . 6. *N. dualis*
11a. Branchlets 1—2 times furcate; dactyls shorter than penultimate rays . . . . 7. *N. globulifera*
b. Branchlets 2—3 times furcate; dactyls longer than penultimate rays . . . . 8. *N. Annandalei*
12a. Dactyls all much elongated 13
b. Dactyls (at least some of them) much abbreviated 25
13a. Oogonia produced at all free branchlet-nodes 14
b. Oogonia not produced at the first free branchlet-node 20
14a. Branchlets indifferently 1—2 times furcate . . . . . . **9. N. axillaris**
b. Branchlets two and more times furcate 15
15a. Branchlets strictly 2 times furcate . . . . **10. N. bipartita**
b. Branchlets 2—5 times furcate 16
16a. Young fertile whorls not enveloped in mucus 17
b. Young fertile whorls enveloped in mucus 19
17a. Oogonia solitary 18
b. Oogonia 1—3 together . . . . **12. N. moniliformis**

[1] Malaysian species in heavy type, those known from Continental Asia in italics.

18a. Plant fairly robust; diam. of the whorls 2 cm and more; antheridia 200—300 μ in diam. . . . . **11b. N. pseudoflabellata** var. **mutila**
b. Plant very minute; diam. of the whorls 0.5 cm; antheridia 175—200 μ in diam. . . . . **13.** *N. batrachosperma*
19a. Plant fairly robust, 20—30 cm high; mucous cloud very dense; oospores 290—350 μ long . . . . **11a. N. pseudoflabellata** var. **mucosa**
b. Plant very minute, up to 10 cm high; mucous cloud very inconspicuous; oospores 225—300 μ long . . . . **13.** *N. batrachosperma*
20a. Young fertile whorls not enveloped in mucus 21
b. Young fertile whorls enveloped in mucus 24
21a. Oospore membrane reticulate 22
b. Oospore membrane granulate 23
22a. Secondary rays 6; a separate little fertile branchlet produced at the first two branchlet-nodes . . . . **15.** *N. flagellifera*
b. Secondary rays 3—4; no such proliferous branchlets produced . . . . **14.** *N. dictyosperma*
23a. Oospores c. 225 μ long; inferior cell of dactyls rounded at distal end . . . . **17.** *N. leptodactyla*
b. Oospores c. 375 μ long; inferior cell of dactyls tapering at distal end . . . . **16.** *N. patula*
24a. Dactyls shorter than penultimate rays; inferior dactylous cell cylindrical and rounded at apex; membrane finely and indistinctly granulate . . . . **17.** *N. leptodactyla*
b. Dactyls longer than penultimate rays; inferior dactylous cell much curved at base and tapering at apex; membrane vermiformously decorated . . . . **18.** *N. Wattii*
25a. Upper and lower cells of coronula not much varying in length . . . 26
b. Upper cells of coronula much elongated 29
26a. Oogonia solitary . . . . **19. N. oligospira**
b. Oogonia aggregated 27
27a. Oogonia at base of whorls . . . . **20.** *N. burmanica*
b. Oogonia not at base of whorls 28
28a. Antheridia 300—355 μ in diam.; oospores 340—405 μ long . . . . **21a. N. tumulosa** var. **typica**
b. Antheridia 230—265 μ in diam.; oospores 245—285 μ long . . . . **21b. N. tumulosa** var. **pumila**
29a. Sterile branchlets 1—2, fertile branchlets 3 times furcate; oospores up to 220 μ long 30
b. Sterile and fertile branchlets 3—4 times furcate; oospores 225—265 μ long . . . . **22b. N. furcata** var. **Zollingeri**
30a. Oospores 180—220 μ long . . . . . . **22c. N. furcata** var. **nicobarica**
b. Oospores 270—310 μ long . . . . . . **22a. N. furcata** var. **Roxburghii**
31a. Dactyls indifferently 2—3-celled (Heterocellulatae) 32
b. Dactyls indifferently 2—5-celled (Pluricellulatae) . . . . **29. N. Allenind**a
32a. Plant dioecious . . . . **23.** *N. superba*
b. Plant monoecious 33

33a. Dactyls not much abbreviated 34
b. Dactyls all much abbreviated 37
34a. Young fertile whorls not enveloped in mucus 35
b. Young fertile whorls enveloped in mucus . . . . . . 26. *N. elegans*
35a. First branchlet-node fertile 36
b. First branchlet-node sterile . . . . . . 25. *N. tenuissima* var. *byssoides*
36a. Secondary rays 4—5; tertiary rays 2—4 . . . . . 24a. **N. mucronata**
b. Secondary rays 5—6; tertiary rays 2—5 . . . . 24b. **N. mucronata** var. **pseudograciliformis**
37a. Oogonia not at base of whorls 38
b. Oogonia at base of whorls . . . . 27. *N. polyoarpa*
38a. Inferior cell of dactyls sub-quadratic; oospores 180—240 μ long . . . . 28a. **N. microcarpa** var. **microglochin**
b. Inferior cell of dactyls twice as long as wide; oospores longer than 240 μ . 39
39a. Oospores 240—280 μ long. . . . . . 28b. **N. microcarpa** var. **Glaziovii**
b. Oospores 300—350 μ long. . . . . . 28c. **N. microcarpa** var. **papuana**

I. Sectio HOMOEOCLEMAE J. Groves in Journ. Linn. Soc., Bot., 46, 1924, p. 360; G. O. Allen in Journ. Ind. Bot. Soc. 7, 1928, p. 51; Pal in Journ. Linn. Soc., Bot., 49, 1932, p. 64; Groves in Journ. Bot. 73, 1935, p. 47; Groves & Allen in Proc. Roy. Soc. Queensl. 46, 1935, p. 40; Zaneveld in Blumea 3, 1939, p. 378 — Subsect. *Homoeophyllae* A. Braun in Hooker's Journ. Bot. 1, 1849, pp. 195, 196; id., id., 1849, pp. 292, 293; von Leonhardi in Lotos 13, 1863, repr. p. 9; id. in Verh. naturf. Ver. Brünn 2, 1864, pp. 36, 38; A. Braun, Consp. syst. Charac. europ., 1867, pp. 1, 2; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, pp. 796, 797; Braun & Nordstedt in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 9, 10; T. F. Allen, Charac. America 1, 1888, pp. 41, 43; Migula, Die Charac., 1897, p. 97; H. & J. Groves in Urban, Symb. Fl. Antill. 7, 1911, p. 30; Nordstedt in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 2; Printz in Engler & Prantl, Nat. Pfl. fam. 3, ed. 2, 1927, p. 427 — Subsect. *Homoeoclemae* Groves & Bullock Webster, Brit. Charoph. 1, 1920, p. 110.

Branchlets of each whorl in a single row; all branchlets nearly uniform in length and degree of furcation.

Key to the subsections.

1a. Dactyls (ultimate rays of the branchlets) strictly one-celled . . . . I. Anarthrodactylae
b. Dactyls more-celled 2
2a. Dactyls indifferently 1—2- or 1—3-celled . . . . . II. Heterodactylae
b. Dactyls 2- or more-celled . . . . III. Arthrodactylae

I. Subsectio ANARTHRODACTYLAE GROVES & BULLOCK WEBSTER, Brit. Charoph. 1, 1920, pp. 86, 96; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 361; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 426; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 51; PAL in Journ. Linn. Soc., Bot., 49, 1932, p. 64; J. GROVES in Journ. Bot. 73, 1935, p. 49; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 40; ZANEVELD in Blumea 3, 1939, p. 378 — *Nitellae Furcatae* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 195, *pro parte* — Sect. *Monarthrae* A. BRAUN ap. VON LEONHARDI in Lotos 13, 1863, repr. p. 9; id. in Verh. naturf. Ver. Brünn 2, 1874, p. 36; A. BRAUN, Consp. syst. Charac. europ., 1867, p. 1 — Sect. *Monarthrodactylae* A. BRAUN in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 796, 1868, *pro parte*; A. BRAUN in COHN, Krypt. Fl. Schles. 1, 1876, p. 368; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 9; T. F. ALLEN, Charac. America 1, 1888, p. 41; MIGULA, Die Charac., 1897, p. 97; H. & J. GROVES in URBAN, Symb. Antill. 7, 1911, p. 30; NORDSTEDT in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 2 — Sect. *Furcinitella* (*Holodactylae*) HY in Bull. Soc. bot. France 60, 1913, Mém. 26, p. 7.

Ultimate rays of the branchlets (dactyls) each consisting of a single cell.

1. **Nitella mirabilis** NORDSTEDT ex J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 361, 364, pl. 35; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 597, pl. 2, f. 2; GROVES & ALLEN in Journ. Bot. 65, 1927, p. 336; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 51, pl. 1, f. 2, text-f. 1; id. in Journ. Ind. Bot. Soc. 15, 1936, p. 51.

Plant dioecious, 15—20 cm high; male and female plants similar. *Internodes* somewhat shorter than the branchlets. *Sterile* and *fertile branchlets* similar, 6—8 in a whorl, once furcate. *Dactyls* 2—4, one-celled. ♂ and ♀ *gametangia* aggregated (2—3 together), long stalked and enveloped in mucus. *Antheridia* 500—600 μ in diam., central one sessile, the lateral ones stalked. *Oospores* golden-brown, 375—475 μ long, with 6 broadly flanged ridges. *Membrane* finely granulate.

Remarks. Especially characterized by the aggregated long-stalked gametangia, enveloped in mucus. No specimens examined.

Ecology. Growing in clumps by itself in open water near the margin, on very soft mud.

Distribution. Between 30° N. and 25° N.; ASIA, China: Yunnan; India: Gangetic Plain.

2. **Nitella acuminata** [1]) A. BRAUN in HOOKER's Journ. Bot. 1,

[1]) The literature and illustrations are cited here and not under the varieties, in those cases, in which an author did not mention to which variety or form a plant belongs.

1849, p. 292; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 30; A. BRAUN in Monatsber. Kön. Akad. Wiss. Berlin, 1858, p. 356; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 35; T. F. ALLEN, Charac. America 1, 1888, p. 41 (*nom. tant.*); H. & J. GROVES in URBAN, Flor. Ind. Occ. 7, 1911, p. 32; RIDLEY in Journ. Straits Branch R. A. Soc. 80, 1919, p. 163; J. GROVES in Philipp. Journ. Sci. 19, 1921, p. 663; id. in Journ. Linn. Soc., Bot., 46, 1922, p. 97; id. in Journ. Linn. Soc., Bot., 46, 1924, pp. 361, 365; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 597; GROVES & STEPHENS in Transact. Roy. Soc. S. Afr. 13, 1926, p. 147; G. O. ALLEN in Journ. Bot. 65, 1927, p. 336; id. in Journ. Ind. Bot. Soc. 7, 1928, p. 53; J. GROVES in Journ. Linn. Soc., Bot., 48, 1928, p. 127; PAL in Journ. Burma Res. Soc. 18, 1929, p. 113 (*nom. tant.*); DIXIT in Journ. Ind. Bot. Soc. 10, 1931, p. 205; MIGULA in Hedwigia 70, 1932, p. 211; MUKERJI in Proc. 19th Ind. Sci. Congr., Bangalore, 1932, p. 328; PAL in Journ. Linn. Soc., Bot., 49, 1932, pp. 64, 66; MUKERJI in Proc. 21st Ind. Sci. Congr., Bombay, 1934, p. 295; J. GROVES in Journ. Bot. 73, 1935, p. 46 (*nom. tant.*); AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, p. 3; ZANEVELD in Blumea 3, 1939, pp. 378, 381 — *Nitella acuminata* var. *indica*; *N. acuminata* var. *indica* f. *brachyteles*, *N. acuminata* var. *javanica*; *N. acuminata* ε *N. Lindheimeri*; *N. acuminata* var. *Lindheimeri*; *N. acuminata* β *N. subglomerata* f. *brachyteles*; *N. Bélangeri*; *N. subglomerata*; *Chara Belangeri*; cf. varieties.

Illustrations[1]). G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, pl. 2, f. 1; id. in Journ. Ind. Bot. Soc. 7, 1928, f. 2; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, pl. 1.

Plant monoecious, bright to brownish green, c. 25 cm high. *Stem* moderately stout, 700—1500 μ in diam. *Internodes* as long as to 1½ times the length of the branchlets. *Sterile branchlets* 6—8 in a whorl, up to 4 cm long, well-developed, in adult specimens curving outwards, once furcate, primary rays $^2/_3$—$^3/_4$ the length of the entire branchlet; secondary rays (dactyls) 2—3, seldom 4, much shorter than the primary rays, extremely variable in length. *Fertile branchlets* frequently in dense heads on separate branchlets of which usually two or three take rise between the sterile whorls; these branchlets sometimes bear not only the compact heads, but also a whorl of 6—8 longer fertile branchlets, c. 1 cm long, whereas the heads are c. 0.2 cm in diam.; both kinds of fertile branchlets are once furcate into 2(—3), short

[1]) Cf. note [1]) on p. 54.

ultimate rays, not enveloped in mucus. *Dactyls* of the sterile branchlets (2—)3, up to 1 cm long, unequal or equal in length, one-celled, at the apex gradually tapering into an acuminate point. The long fertile branchlets have also 2—3 one-celled dactyls, which are much shorter than the sterile ones, being up to 0.2 cm long, and more or less conical; this is also the case in the dactyls of the fertile heads which are 2—4 in number, up to 790 μ long and 125 μ wide at base. ♂ and ♀ *gametangia* together at the same nodes, destitute of gelatinous covering. *Antheridia* solitary, sessile, strictly terminal, 230—310 μ in diam., earlier ripe than the oogonia. *Oogonia* 1—2, seldom 3 together, sessile, lateral, 280—510 μ long (incl. coronula), 240—400 μ wide; *spiral-cells* showing 8—9 convolutions; *coronula* persistent, 33—85 μ high, 45—130 μ wide at base, individual cells strongly converging; *oospores* dark chestnut-brown, subdiaphanous (in dried specimens nearly black), 275—340 μ long, 225—300 μ wide with (6—)7(—8) ridges; *outer membrane* minutely granulate, diaphanous.

Remarks. *Nitella acuminata* is an extremely variable species with an extensive distribution in the tropics and subtropics.

When BRAUN founded this species in 1849, he divided it into three varieties, viz. *Bélangeri* (BRAUN wrote "*Bellangeri*", cf. this var.) from the coast of Coromandel, *Lindheimeri* from Missouri and Texas, and *mauritiana* from Mauritius. In 1858, BRAUN described two new closely related species from Columbia and Guyana, viz. *Gollmeriana* and *subglomerata*. A first review of the acuminate species belonging to the monoecious monarthrodactylous group was given by BRAUN in his "Characeen Afrika's" (1868, p. 804), in which is primarily stated that *N. Gollmeriana* and an earlier described North-American species *N. glomerulifera* (1844) must be considered as subspecies of *N. acuminata*, whereas *N. subglomerata*, the three varieties distinguished in 1849, and a not named form from Java and Mindanao (in 1882 published as var. *indica*) must be regarded as varieties. In this way it is published in the "Fragmente einer Monographie der Characeen" (1882), in which publication BRAUN again stressed that there are "keine wesentlichen Unterschiede" between *Lindheimeri* and *Bélangeri* and that the var. *indica* is "eine ähnliche mit *N. acum. subglomerata* habituell ganz übereinstimmende Form". The differences between the varieties are based upon: 1. the gametangia being solitary or aggregated, 2. the sterile branchlets being longer or shorter than the fertile branchlets which are contracted into heads, and 3. the comparative length of the primary and secondary rays.

This subdivision was taken over by the eminent specialist of American *Charophyta*, T. F. ALLEN, in 1888. Afterwards (1892, p. 7), however, this author changed his view, also appearing from his review in 1896 (p. 535), in which are cited as separate species, *N. subglomerata* var. *indica, N. mauritiana, N. subglomerata* [1]), *N. glomerulifera*, whereas three new species are added to this already highly variable group, viz. *N. stellaris, N. capitulifera* and *N. subspicata* (*Gollmeriana* is not mentioned at all), mainly separated on account of their smooth oospore membrane, which in the other "species" is granulate or reticulate.

As appears from the literature quotations at the heading of this species most authors of the 20th century have only cited the plants as belonging to *N. acuminata* and did not mention the variety. GROVES (1922, p. 98) argues that the length of the primary rays and the dactyls is extremely variable even in specimens of the same gathering. I can only confirm this, as the specimen from Java in herb. VAN DEN BOSCH has aggregated oogonia, whereas the sterile branchlets are longer than the fertile ones, thus being intermediate between the varieties *Bélangeri* and *indica*.

As I was able to study the types of the last named varieties I could notice a remarkable difference in the length of the dactyls: in *Bélangeri* most of them are hardly macroscopically visible, in *indica*, on the other hand, easily. However, the Concan plant (Bombay) mentioned in 1882 (p. 38) by BRAUN as belonging to var. *Bélangeri* has much longer dactyls and is hardly different from *indica*.

A peculiarity found in the type specimen of *indica* is the presence of geminate oogonia, so that BRAUN's remark (1882, p. 37): "Fructification fehlt" is probably a mistake. The geminate oogonia are doubtless also present in the specimens of VAN DEN BOSCH, reasons why var. *indica* is identic with the earlier published *subglomerata*, which I regard as a variety.

On the other hand, I would unite *N. Lindheimeri* and *Bélangeri* into one variety, under the name of the last one. Most probably T. F. ALLEN's *N. stellaris, N. capitulifera* and *N. subspicata* also belong to our var. *subglomerata*; though I did not see the types I could study the exsiccatae from the herbarium of T. F. ALLEN and the only difference found is the decoration of the oospore membrane, which is indeed

[1]) *N. Lindheimeri* inclusive. Probably the var. *Bélangeri* is at the same time included in this species as ALLEN writes (1892, p. 7): "*N. Lindheimer* (*sic*) A. BR. ... is very closely related to *N. Bélanger* (*sic*) A. BR.".

quite smooth. Concerning this point it is remarkable that NORDSTEDT (1889, p. 7) states that the membrane is also smooth in young plants of var. *subglomerata* and as the distributed specimens were not fully mature, this peculiarity must be studied again before a decision can be given. The decoration of the oospore membrane alone is not essential enough to maintain specific rank.

N. acuminata differs from the other monoecious *Anarthrodactylae* mainly in having tapering dactyls and a persistent coronula, which are peculiar to *N. flexilis*, *N. californica*, *N. mexicana* and *N. laxa*, whereas the likewise acuminate *N. praelonga* has much larger gametangia and the fertile whorls enveloped in mucus.

E c o l o g y. *Nitella acuminata* is a rather robust species, without any trace of incrustation, but it is sometimes covered by clay. It occurs in large masses in rice-fields, road-side pools, ditches, swamps, springs, in open places protected by rushes, and was once recorded from a river.

According to GROVES & ALLEN (1927, p. 336), it is abundant in Saharanpur in the rainy season, but PAL writes (1932, p. 67) that it was only found in Burma after the monsoon was well past. The bottom may consist of clay and of fine sand.

The size of the plants most probably depends on the environmental conditions, as PAL (1932, p. 67) writes that in pools about to dry up the plants were small and stunted, and the fertile branchlets studded with ripe brown oospores, while in the deeper pools close at hand in Burma very stout sterile specimens were found.

MUKERJI (1932, p. 328) records *N. acuminata* from a depth of 7.50 m and states that it appears to possess great powers of tolerating very low intensities of light, although it is fully capable of growing in very bright light. This is suggested by PAL, who cites (*l. c.*, p. 54) that plants of *N. acuminata* grown in glass jars and placed at a well lighted window still suffered from lack of sufficient illumination, which was manifested by thin and lanky growth. It is also absent in those parts where there is plenty of sedimentation.

It is found both in the hills (Java, 260—300 m alt.) and in the lowlands. In India it is recorded by G. O. ALLEN as bearing gametangia from August to December (1928, p. 66), whereas PAL cites (*l. c.*, p. 51) from November to March. I found ripe oospores in plants of var. *Bélangeri* collected from May to November and in var. *subglomerata* from April to December. *Spirogyra* species are mentioned as algal epiphytes and were found in some specimens.

N. acuminata is seldom solitary in growth, being usually found together with *Nitella mucronata* and *Chara fibrosa* ssp. *gymnopitys*, and the Phanerogams *Najas, Scirpus, Marsilia, Eriocaulon truncatum, Xyris indica.*

Distribution[1]). Between 45° N. and 20° S.; ASIA, India, Malaysia, cf. varieties. Moreover in lit.: Japan, MIGULA (1930, p. 211) — AMERICA, N. Am.: Lake Ontario, T. F. ALLEN (1892, p. 8, *glom.*); United States, cf. varieties, for var. *glomerulifera*, cf. BRAUN & NORDSTEDT (1882, p. 40), NORDSTEDT (1889, pp. 7, 23), T. F. ALLEN (1892, p. 8); C. Am.: Mexico, Panama, Cuba, Porto Rico, Trinidad, Martinique, cf. varieties; S. Am.: Venezuela, BRAUN & NORDSTEDT (1882, p. 40, var. *glom.* and *Gollm.*), NORDSTEDT (1889, p. 7, *Gollm.*); Brazil, BRAUN & NORDSTEDT (1882, p. 35) — AFRICA, N. Afr.: Egyptian Sudan: Seriba Ghattas, BRAUN & NORDSTEDT (1882, p. 35); S. Afr.: S. Rhodesia, GROVES & STEPHENS (1926, p. 147); Madagascar, GROVES (1928, p. 127), ZANEVELD (1939, p. 381); Mauritius, BRAUN (1849, p. 293; 1868, p. 804), BRAUN & NORDSTEDT (1882, p. 35); Réunion, BRAUN (1868, p. 804, *mauritiana* ?).

var. α **Bélangeri** A. BRAUN in HOOKER's Journ. Bot. I, 1849, p. 292; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 30; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 10, 38; T. F. ALLEN, Charac. Americ. 1, 1888, p. 43 (*nom. tant.*); H. & J. GROVES in Philipp. Journ. Sci. 7, 1912, p. 70 — *Nitella Belangeri* A. BRAUN in Monatsber. Kön. Akad. Wiss. Berlin, 1858, p. 355 (*nom. tant.*); id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 804, 1868 (*nom. tant.*) — *N. acuminata* β *N. subglomerata* A. BR. f. *brachyteles* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 37; T. F. ALLEN, Charac. America 2, 1892, p. 7 — *N. acuminata* A. BR. var. *indica* A. BR. f. *brachyteles* NORDSTEDT in Forsch. Reise S. M. S. "Gazelle", Bot. Th. 4, 1889, p. 6 — *N. acuminata* A. BR. var. *Lindheimeri* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 293 (*nom. tant.*); T. F. ALLEN, Charac. America 1, 1888, p. 43 (*nom. tant.*) — *N. acuminata* ε *N. Lindheimeri* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 38 — *N. Lindheimeri* A. BRAUN in Monatsber. Kön. Akad. Wiss. Berlin, 1858, p. 355 (*nom. tant.*); id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 805, 1868 (*nom. tant.*); T. F. ALLEN, Charac. America 2, 1892, p. 7 (as *N. Lindheimer*) — *Chara Belangeri* A. BRAUN in lit.

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[1]) This cannot be given complete, as the various authors did not always cite the variety to which a specimen belongs.

Illustration. BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pl. 1, f. 25.

Plants with very short dactyls, in the type specimen hardly visible with the naked eye, in other specimens up to as long as the diam. of the stem.

As I had the opportunity to study the type, I give some data thus far unpublished. *Stem* diam. up to 1 mm. *Sterile branchlets* 1–3 cm long, at the apex provided with 3—4 dactyls, c. 500 μ long. *Antheridia* c. 284 μ in diam. *Oogonia* 356—400 μ long (incl. coronula), 302—320 μ wide; *spiral-cells* showing 7—9 convolutions; *coronula* c. 80 μ high, c. 124 μ wide at base, individual cells strongly converging and persistent; *oospores* bright-brown, 267 μ long, 240 μ wide, with 6—7 broad ridges with very prominent flanges (about 8 μ); *outer membrane* coarsely granulate and diaphanous.

INDIA: Coromandelia, in pools near Gengu, 1826—'28, BÉLANGER s.n. (B) — *type*; Malabaria, Bombay, Concan, 1847, STOCKES s.n., herb. HOOKER in (B).

JAVA: Batavia, Ragoenan, Pasarminggoe, X 1930, Geneesk. Dienst v. Malaria Bestrijd. s.n. (Bz); Buitenzorg, Buitenzorg, in a rice-field along the road to Tjiboerial, 260 m alt., 9 V 1928, VAN STEENIS 1510 (Bz); Malang, Roemah Klampok, 300 m alt., 14 V 1936, J. H. ? 75 (Bz).

PHILIPPINE ISLANDS: Luzon, Prov. of Laguna, VI—VII 1915, MACGREGOR, Bur. of Sci. 27630 (K).

AMBOINA: Amboina, 11 VI 1875, B.N. (= NAUMANN) 364 (B), *type* of *N. acuminata* A. BR. var. *indica* A. BR. f. *brachyteles* NORDST.; ibid., same date, B. N. 367 (B).

Remarks. Variety *Bélangeri* is characterized by its very short dactyls though there are transitions to var. *subglomerata*.

There is some confusion about the orthography of the name of this variety. In the type description (1849, p. 292) BRAUN writes a double l but omits the accent, and cites the name of the collector, CH. BÉLANGER, likewise. However, in 1858 (p. 355) and in 1868 (pp. 804, 805) BRAUN himself writes "*Belangeri*". On the label of the type specimen BRAUN has written "*Nitella Bellangeri* A. BR. 1838", but one *l* is struck out. This is probably done by BRAUN himself in 1858 as there is on the same label a note in BRAUN's handwriting: "*Nitella* (*acuminata*) *Belangeri* 1858". It is therefore without any doubt that "*Bellangeri*" is an unintentional orthographic error and the variety must be written as *Bélangeri*.

Distribution [1]). Between 40° N. and 15° N.; ASIA, Coro-

[1]) Cf. note [2]) on p. 59.

m a n d e l i a, M a l a b a r i a. Moreover in lit.: AMERICA, U n i t e d S t a t e s: Missouri, BRAUN (1849, p. 293); T e x a s, BRAUN (1849, p. 293), BRAUN & NORDSTEDT (1882, p. 38).

var. β **subglomerata** A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 36 (as *N. acuminata β N. subglomerata*); T. F. ALLEN, Charac. America 1, 1888, p. 41 (*nom. tant.*); NORDSTEDT in Hedwigia 27, 1888, pp. 181, 194; id. in Lunds Univers. Års-skr. 25, 1889, p. 7; H. & J. GROVES in Journ. Linn. Soc., Bot., 33, 1898, p. 325; id. in URBAN, Fl. Ind. Occ. 7, 1911, p. 33 — *Nitella subglomerata* A. BRAUN in Monatsber. Kön. Akad. Wiss. Berlin, 1858, p. 356; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 805, 1868; T. F. ALLEN, Charac. America 2, 1892, pp. 2, 7 — *Nitella acuminata* A. BR. var. *indica* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 9, 38; T. F. ALLEN, Charac. America 1, 1888, p. 41 (*nom. tant.*); NORDSTEDT in Lunds Univers. Års-skr. 25, 1889a, p. 7; id. in Forschungsreise S. M. S. "Gazelle", 1889b, p. 6; DE WILDEMAN, Prodr. Fl. Alg. Ind. Néerl. 1897, p. 31; id., Suppl. et Tabl. Stat., 1899, p. 98; id., Alg. Fl. Buitenz., 1900, p. 374; H. & J. GROVES in Philipp. Journ. Sci. 7, 1912, p. 70; H. GROVES in Journ. Linn. Soc., Bot., 42, 1914, p. 213 — *Nitella acuminata* A. BR. var. *javanica* A. BRAUN in herb. Berol.; id. in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 49 (*nom. tant.*).

I l l u s t r a t i o n s. BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pl. 1, figs. 22—24, 26; T. F. ALLEN, Charac. America 2, 1, 1892, unnumbered pl.

Dactyls of the *sterile branchlets* macroscopically visible, longer than 650 μ. Primary rays as long as to ¾ as long as the secondary rays (dactyls). *Dactyls* of the *fertile branchlets* very short.

MALAY PENINSULA: S t r a i t s S e t t l e m e n t s, 8 VII 1896, BLOW 51 (K); S i n g a p o r e, Tanglin Ditches, 1898, RIDLEY 9137 (K, Si).

SUMATRA: W e s t C o a s t, near Padang, in the river, 13 IV 1888, WEBER 554 (L).

JAVA: B a t a v i a, near Batavia, in swamps, 1855, HASSKARL s.n. (B), *type* of *N. acuminata* var. *indica*; ibid., Batavia, without collector's name (probably JUNGHUHN) and date, ex herb. VAN DEN BOSCH (B, L).

PHILIPPINE ISLANDS: M i n d a n a o, near Sambang, in a ditch, VI 1861 (Prussian Exped. to East-Asia, 1860—'62), WICHURA 2005 (B).

AMBOINA: A m b o i n a, near the coal-shed in a fresh water ditch, 11 VI 1875, NAUMANN 365 (B); ibid., same date, NAUMANN 366 (B); ibid., VI—XI 1913, ROBINSON 2404 (Bz, L).

R e m a r k s. This variety is at once distinguished by the macroscopically dactyls.

I have cited var. *indica* as a synonym, as I cannot find any difference. Whilst BRAUN writes (1882, p. 37) that the type specimen bears no gametangia I found immature ones. The oogonia appear to be geminate and the antheridia solitary. Therefore, it appears incorrect that NORDSTEDT in his "Clavis" in the "Fragmente" (1882, p. 9) has separated var. *indica* from var. *subglomerata* on account of its solitary oogonia. The geminate oogonia were also present in the specimen in herb. VAN DEN BOSCH at Leiden. In the Berlin specimen, BRAUN could not state this with certainty. About the Mindanao specimen, BRAUN remarked already (1882, p. 37) that it has quite the same habit as *subglomerata*. Therefore, they are undoubtedly identic and the name *subglomerata* has date priority.

On the cover of the type specimen of var. *indica* BRAUN himself has written "*Nitella acuminata* var. *javanica* mihi"; this name is also cited on p. 49 of the "Fragmente", however, the variety has been published under the name *indica*.

Distribution[1]). Between 45° N. and 10° S.; ASIA, Malaysia: Malay Peninsula, Sumatra, Java, Philippine Islands, Amboina. Moreover in lit.: Borneo, GROVES (1914, p. 213) — AMERICA, N. Am.: United States: Oregon, New York, Illinois, T. F. ALLEN (1892, p. 7), NORDSTEDT (1889a, p. 7); Pennsylvania, BRAUN & NORDSTEDT (1882, p. 32), T. F. ALLEN (1892, p. 7); New Jersey, T. F. ALLEN (1892, p. 7); Missouri, St. Louis, Texas; C. Am.: Mexico, BRAUN & NORDSTEDT (1882, p. 37), T. F. ALLEN (1892, p. 7); Sauvies Islands, T. F. ALLEN (1892, p. 7); Panama, BRAUN (1858, p. 356), BRAUN & NORDSTEDT (1882, p. 36); Cuba, NORDSTEDT (1888, p. 181), GROVES (1911, p. 23); Porto Rico, Martinique, GROVES (1911, p. 23), Trinidad, GROVES (1898, p. 325; 1911, p. 33); S. Am.: Brazil, BRAUN & NORDSTEDT (1882, p. 36), NORDSTEDT (1889a, p. 7).

II. Subsectio HETERODACTYLAE A. BRAUN in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 807, 1868 (*nomen propositum*); GROVES & STEPHENS in Trans. Roy. Soc. S. Afr. 13, 1926, p. 145; J. GROVES in Journ. Bot. 73, 1935, p. 48; ZANEVELD in Blumea 3, 1939, p. 378 — Subsect. *Arthrodactyles* HY in Bull. Soc. bot. France 60, 1913, Mém. 26, p. 12, *pro parte* — Subsect. *Stenodactyles* HY in Bull. Soc. bot. France 60, 1913, Mém. 26, p. 16, *pro parte*.

Ultimate rays of the branchlets indifferently 1—2- or 1—3-celled.

[1]) Cf. footnote on p. 59.

3. **Nitella sumatrana** FILARSZKY in Arch. Hydrobiol. 1934, Suppl. Bd. 12, Trop. Binnengew., Bd. 4, pp. 709—711; id. in Math. u. Naturw. Anz. Ung. Akad. Wiss. 52, 1935, p. 468 (*nom. tant.*).

Illustrations. FILARSZKY, *l. c.* 1934, figs. 9—14; the pres. paper, figs. 4*a*—*f*.

Plant monoecious, rigid but fragile, up to 15 cm high (probably much higher). *Stem* slender, 375—450 μ in diam. *Internodes* half to twice the length of the branchlets. *Sterile branchlets* 7—8 in a whorl, 1—2 times furcate, 1—1.5 cm long, primary rays $^1/_3$—$^2/_3$ the length of the entire branchlet, secondary rays 4—6, tertiary rays (dactyls) 2—4, ± as long as the secondary ones (the lower whorls are all sterile). *Fertile branchlets* 5(—6) in a whorl, twice furcate, c. 0.5 cm long, primary rays $^3/_5$ as long as the entire branchlet, secondary rays 4—5, half as long as the tertiary rays, tertiary rays (dactyls) 3—4. The upper whorls are fertile, becoming more and more compact towards the apex of the plant (the "apikale Kurztrieben" of FILARSZKY, 1934, p. 709). One of these compact heads of fertile whorls is also present in the axils of the lower sterile whorls (FILARSZKY's "axiale Kurztrieben"). These compact fertile whorls are covered by a mucilagous cloud. *Dactyls* of the normal fertile rays longer than those of the sterile ones, occasionally one-celled but frequently two-celled, basal cell proportionally very long, viz. 70—80 μ, 3—4 μ wide with a swollen rounded end, flattened at the apex where the ultimate cell is inserted; ultimate cell short, allantoid, 4—5 μ long, 2—3 μ wide at base. The dactyls of the sterile whorls are much longer, up to 2 mm, two-celled, basal cell c. 700—1000 μ wide[1]). ♂ and ♀ *gametangia* sessile, together at the same nodes, except at the base of the primary rays. *Antheridia* solitary, terminal, c. 180—228 μ in diam. *Oogonia* solitary, lateral, 384—440 μ long (incl. coronula), 258—325 μ wide; *spiral-cells* showing 8—9 convolutions; *coronula* 44—56 μ high, 51—79 μ wide at base, evanescent, individual cells convergent, rounded at apex; *oospores* dark-brown, 263—335 μ long, 180—226 μ wide, with 6—7 ridges; *outer membrane* minutely granulate.

SUMATRA: Tapanoeli, Lake Toba, border of Samosir near Pangoeroeran (total depth 50—80 m), basin of Pangoeroeran from 1 m depth, 12 IV 1929,

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[1]) FILARSZKY writes (p. 710) that the dactyls of the sterile and fertile whorls are often monarthrodactylous, however, this seems to be the case, as frequently the ultimate cell is dropped. The dactyls are badly represented in the figs. 9—14 of FILARSZKY.

German Limnol. Sunda Exped. TS 2a (Bu-Mus), *type*; ibid., S. border of the Porsea basin, at 3 m depth (total depth 450 m), 8 IV 1929, German Limnol. Sunda Exped. TP 1d (Bu-Mus).

Remarks. *Nitella sumatrana* is best characterized by the shape of the indifferently one- and two-celled dactyls. It comes very near to the monoecious *Heterodactylae*, viz. *N. abyssinica*, and *N. divaricata* from Africa, *N. inaequalis* from Madagascar, and *N. tuberculata* from Bengal. Now *N. divaricata* has the ultimate node of the branchlets sterile and the fertile whorls do not form condensed heads, *N. inaequalis* has the rays different in length and the ultimate cell of the two-celled dactyls is conspicuously contracted at the base, and, whilst both species have reticulate oospore membranes, in *N. tuberculata* the membrane is tuberculate. *N. abyssinica* differs in having the branchlets 3—4 times furcate.

Ecology. *N. sumatrana* is a rather slender plant, occurring in the upper layers of lakes with a great depth. The following particulars are still known from the second locality mentioned above, i. e. temp. of the surface 25°—27° C., alkalinity 1.56, conductivity $1.33 \cdot 10^{-4}$, pH 8.3.

The species were infested with a great number of epiphytes, especially blue algae, viz. *Rivularia aquatica*. Between the dried material were fragments of *Chara australis* var. *Vieillardii* f. *simplicissima* and *C. zeylanica*.

Distribution. 3° N.; Asia, Malaysia: Sumatra.

4. Nitella tuberculata Kundu in Journ. Ind. Bot. Soc. 16, 1937, p. 223, figs. 1—12.

Plant monoecious, up to 15 cm high. *Internodes* somewhat exceeding the branchlets in length. *Sterile branchlets* 4—6 in a whorl, 2 cm long; secondary rays 4—5. *Fertile branchlets* usually 5, shorter than sterile ones; secondary rays 5—6; both kinds of branchlets 2—3 times furcate, not enveloped in mucus. *Dactyls* 2—3, occasionally one-celled, usually two-celled and rarely three-celled. ♂ and ♀ *gametangia* together at the second branchlet-node (lacking at the first node and at the base of the whorls), and also in lax heads, produced as an accessory shoot to the first branchlet-node. *Antheridia* solitary, 195—210 μ in diam. *Oogonia* solitary; *oospores* "light-yellow", 345 μ long, with 7—8 prominent ridges. *Membrane* tuberculate.

Fig. 1, *Nitella bipartita*; *a.* habit, nat. size; *b.* stem-node with fertile branchlet, × c. 20; *c.* decoration of oospore membrane, × c. 200 — Fig. 2, *Nitella moniliformis*, n. sp.; *a.* habit, nat. size; *b.* stem-node with fertile branchlet, × c. 27; *c.* decoration of oospore membrane, × c. 210 — Fig. 3, *Nitella Alleninda*, n. sp.; *a.* habit, nat. size; *b.* stem-node with fertile branchlet, × c. 20; *c.* sterile branchlet, × c. 7; *d.* decoration of oospore membrane, × c. 200; *e—h.* apices of dactyls, × c. 20.


1a
1b
1c
2a
2b
2c
3a
3b
3c
3d
3e
3f
3g
3h
MULDER ET MARKS DEL.

Remarks. Special features of this species are the partly one-, partly two-, and partly three-celled dactyls, and the tuberculate "NORDSTEDT-markings". No specimens examined.

Ecology. In a shallow ditch together with *Ceratophyllum* and *Najas* species.

Distribution. 25° N.; ASIA, India: Bengal.

III. Subsectio ARTHRODACTYLAE GROVES & BULLOCK WEBSTER, Brit. Charoph. 1, 1920, pp. 86, 110; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 361; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 426; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 51; PAL in Journ. Linn. Soc., Bot., 49, 1932, p. 64; J. GROVES in Journ. Bot. 73, 1935, p. 49; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 40; ZANEVELD in Blumea 3, 1939, p. 379 — Sect. *Pleonarthrae* VON LEONHARDI in Verh. naturf. Ver. Brünn 2, 1864, repr. p. 37.

Dactyls (ultimate rays of the branchlets) each consisting of two or more cells.

Key to the series.

1a.	Dactyls strictly two-celled	1. BICELLULATAE
b.	Dactyls more-celled	2
2a.	Dactyls indifferently 2—3-celled	2. HETEROCELLULATAE
b.	Dactyls indifferently 2—6-celled	3. PLURICELLULATAE

1. Series BICELLULATAE J. GROVES in Journ. Bot. 73, 1935, p. 49 (*nom. tant.*); GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 40; ZANEVELD in Blumea 3, 1939, p. 379 — *Nitellae mucronatae* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 195, *pro parte* — Subsect. *Diarthrae* A. BRAUN ap. VON LEONHARDI in Lotos 13, 1863, repr. p. 11, *pro parte*; id. in Verh. naturf. Ver. Brünn 2, 1864, repr. p. 37; A. BRAUN, Consp. syst. Charac. europ., 1867, p. 2 — Sect. *Diarthrodactylae* A. BRAUN in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 797, 1868; id. in COHN, Krypt. Fl. Schles., 1876, p. 368; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 10; T. F. ALLEN, Charac. America 1, 1888, p. 43; MIGULA, Die Charac., 1897, p. 97; H. & J. GROVES in URBAN, Symb. Antill. 7, 1911, p. 30; NORDSTEDT in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 2 — Subsect. *Stenodactyles* HY in Bull. Soc. bot. France 60, 1913, Mém. 26, p. 16, *pro parte*.

Dactyls (ultimate rays of the branchlets) strictly two-celled.

5. **Nitella flagelliformis** A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 294; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 20; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 47, pl. 5, figs. 115—117 — *Nitella flabelliformis* in herb. Berolinense — *Nitella dispersa* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 10, 47; id. in Monatsb. Kön. Akad. Wiss.

Berlin f. 1867, p. 797, 1868 (*nom. tant.*); T. F. ALLEN, Charac. America 1, 1888, p. 44 (*nom. tant.*); NORDSTEDT in Lunds Univers. Års-skr. 25, 1889, p. 8; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 361, 365; GROVES & ALLEN in Journ. Bot. 65, 1927, p. 336; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 53, pl. 2, f. 1, text-f. 4; MIGULA in Hedwigia 70, 1930, p. 212; MUKERJI in Proc. 19th Ind. Sci. Congr., Bangalore, 1932, p. 328; id. in Proc. 21th Ind. Sci. Congr., Bombay, 1934, p. 295; G. O. ALLEN in Journ. Ind. Bot. Soc. 15, 1936, p. 51; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S., 1, 1937, pp. 3, 4, pl. 2.

Plant dioecious, dirty-green, flexible, transparent, 15—20 cm high. *Stem* rather slender, 384—600 μ in diam. Lower *internodes* as long as the branchlets, upper ones shorter. *Sterile branchlets* long, c. 2 cm, similar to the fertile branchlets. *Fertile branchlets* 5—7 in a whorl, not contracted into heads, up to 2 cm long, 4(—5) times furcate; primary rays half as long as the entire branchlet; secondary rays 5—6 of which 3—4 are again furcate into 3—5 tertiary rays, 2—3 of these latter again furcate into 3—4 quaternary rays, some of these sometimes again divided into 2—3 quinary rays; not enveloped in mucus. *Dactyls* of sterile and fertile branchlets similar, 2—4, unequal in length, uniformly two-celled, lower cell frequently long but varying in length, somewhat rounded at the apex, ultimate cell usually conical, but allantoid ones also occur; in the latter case the lower cell is also very much elongated. ♂ and ♀ *gametangia* sessile, solitary, in all the furcations of the branchlets. *Antheridia* 320—540 μ in diam. *Oogonia* 400—520 μ long (incl. coronula), 304—325 μ wide; *spiral-cells* showing 8—9 convolutions; *coronula* 45—58 μ high, c. 106 μ wide at base; *oospores* dark-brown, 302—350 μ long, 248—280 μ wide, with 6—8 prominent, sharp flanged ridges; *outer membrane* imperfectly reticulate.

INDIA: "India orientalis", without exact locality, date and collector's name, ex herb. DESFONTAINES in (B), *type*; Malabaria, Prov. of Bejapur, Concan, 1847, STOCKES s.n. (B); Assam, without exact locality, date and collector's name, ex herb. HOOKER in (B).

Remarks. A fairly uncommon species, up to 1930 only known from India, but in that year also recorded from Japan. *Nitella flagelliformis* is closely allied to *N. dualis*, *N. globulifera* and *N. Annandalei*, three other dioecious macrodactylous species with uniformly two-celled dactyls. The latter two species are insufficiently known (oospores!). *N. flagelliformis* differs from these two species in having more furcate branchlets, whereas *N. dualis* is gloeocephalous. The other species belonging to this group are hitherto only recorded from Australia.

A little note about the nomenclature of this species may be made. This species was first published by BRAUN in 1849 under the name of *N. flagelliformis*. Afterwards BRAUN detected between the type specimens fragments of another *Nitella* which was published by him in 1882 (p. 54) as *N. pseudoflabellata*. In BRAUN's opinion it was therefore not justified to maintain the name of *N. flagelliformis* and he renamed the species as *N. dispersa*. (1882, p. 47). This is, of course, in contradiction to the now adopted Nomenclatural Rules, reason why the name *dispersa* has to be rejected and that of *flagelliformis* re-established.

Ecology. *Nitella flagelliformis* is found growing in dense tufts in shallow water with a soft muddy bottom of large pools and ponds. It is found in India in the rainy season and in the early to middle cold season. In the habitats

mentioned it grows together with *Nitella acuminata* var. *Bélangeri*, *N. furcata*, *Chara Braunii*, *C. corallina*, *C. brachypus* and *C. zeylanica*.

In Kashmir MUKERJI found it together with *Nitella acuminata*, *N. hyalina* and *Nitellopsis obtusa* to a depth of 7.50 m.

Distribution. Between 35° N. and 17° N.; ASIA, India: Malabaria and Assam. Moreover in lit.: Japan: MIGULA (1930, p. 212); India: W. Himalaya, MUKERJI (1932, p. 328; 1934, p. 295); Gangetic Plain, GROVES & ALLEN (1927, p. 336); ALLEN (1928, p. 63; 1936, p. 51).

6. Nitella dualis NORDSTEDT in Forschungsr. S. M. S. "Gazelle", 4. Th. Bot., 1889, p. 7, pl. 1, figs. 1—9; T. F. ALLEN, Charac. America 1, 1888, p. 48 (*nom. tant.*); NORDSTEDT in Act. Univers. Lund. 25, 1889, p. 13; J. GROVES in Philipp. Journ. Sci. 19, 1921, p. 663.

Plant dioecious, slender, elongate. *Internodes* of the sterile branchlets 2—4 times, those of the fertile branchlets 1—2 times the length of the branchlets. *Sterile branchlets* 6 in a whorl, 1—1.5 mm long, 3—4 times furcate; secondary rays 5—7. *Fertile branchlets* 6 in a whorl, up to 1 cm long, 2—3 times furcate; secondary rays 5—7; contracted into heads enveloped in mucus. *Dactyls* 3—4, uniformly two-celled. ♂ and ♀ *gametangia* together at all free branchlet-nodes, not at the base of the whorls, solitary. *Antheridia* c. 200 μ in diam. *Oospores* chestnut-brown, 180—260 μ long. *Membrane* reticulate, the meshes c. 5 μ in diam.

Remarks. Nearly allied to *N. flagelliformis*, but differing by the larger oogonia and the fertile heads enveloped in mucus. The ultimate dactylous cell is allantoid, which gives the plant at first sight an external resemblance with a polyarthrodactylous species. In this group indeed the species was placed by T. F. ALLEN (1888, p. 48), but this, I presume, is not correct, as the dactyls are distinctly two-celled. No specimens examined.

Ecology. Unknown.

Distribution. Between 12°30′ N. and 6°20′ N.; ASIA, Indo China — AFRICA, Liberia.

7. Nitella globulifera PAL in Journ. Linn. Soc., Bot., 49, 1932, pp. 64, 69, pl. 9; id. in Journ. Burma Res. Soc. 18, 1929, p. 113 (*nom. tant.*).

Plant dioecious, very small. *Internodes* 2—4 times the length of the branchlets. *Sterile* and *fertile branchlets* ± similar, once or twice furcate; secondary rays 6—8. Fertile branchlets in heads enveloped in dense mucus. *Dactyls* 4—6, two-celled. ♂ and ♀ *gametangia* together at both branchlet-nodes, solitary. *Antheridia* 370 μ in diam. *Oogonia* 350 μ long (incl. coronula), showing 9—10 convolutions of the spiral-cells. *Oospores* not described.

Remarks. Different from *Nitella Annandalei* and *N. dispersa* by its less furcate branchlets. Otherwise characterized by the length of the penultimate rays, which are longer than the dactyls. No specimens examined.

Ecology. In a swift running stream, together with *Chara nuda*.

Distribution. 22° N.; ASIA, India: Burma.

8. Nitella Annandalei PAL in Journ. Linn. Soc., Bot., 49, 1932, pp. 64, 70, pl. 10; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 361, 365 (as *N.* sp. nov. ?).

Plant dioecious, rather stout. *Internodes* 2—5 times the length of the branchlets. *Sterile* and *fertile branchlets* ± similar, 8 in a whorl, 2—3 times

furcate; secondary rays 6—8. Fertile whorls enveloped in mucus. *Dactyls* usually 6, two-celled, ultimate cell very narrow and acute. *Antheridia* at all free branchlet-nodes, solitary, 375—450 μ in diam. Female plant unknown.

Remarks. Nearly allied to *Nitella globulifera*, but antheridia larger, dactyls longer than the penultimate rays, and the branchlets more furcate. No specimens examined.

Ecology. In a river.

Distribution. 20° N.; ASIA, India: Burma.

9. **Nitella axillaris** A. BRAUN in Monatsb. Kön. Akad. Wiss. Berlin, 1858, p. 356; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 11, 48; T. F. ALLEN, Charac. Americ. 1, 1888, p. 44 (*nom. tant.*); NORDSTEDT in Hedwigia 70, 1888, pp. 182, 194; id. in Act. Univers. Lund. 25, 1889, p. 9; T. F. ALLEN, Charac. Americ. 2, 2, 1894, pp. 9, 15; id. in Bull. Torrey Bot. Cl. 25, 1898, p. 73 (*nom. tant.*); H. & J. GROVES in URBAN, Symb. Antill. 7, 1911, pp. 30, 34; GROVES & ALLEN in Journ. Bot. 65, 1927, p. 336; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 55 — *Nitella axillaris* A. BR. var. *javanica* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 49; DE WILDEMAN, Fl. Alg. Ind. Néerl., 1897, p. 31; id., Suppl. et Tabl. Stat., 1899, p. 98; id., Alg. Fl. Buitenz., 1900, p. 375.

Illustrations. BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pl. 1, figs. 35—38 and pl. 5, figs. 118—122 (var. *javanica*); T. F. ALLEN, Charac. Americ. 2, 2, 1894, unnumbered plate; DE WILDEMAN, Alg. Fl. Buitenz., 1900, f. 139; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, pl. 3.

Plant monoecious, transparent, shining, in dried specimens brown by the covering with clay, in living state, however, probably bright-green, 25—45 cm high. *Stem* stout, 800—1100 μ in diam. *Internodes* 1½—4 times the length of the branchlets. *Sterile branchlets* (4—)6 in a whorl, c. 2 cm long, once furcate, primary rays nearly as long as the entire branchlets, secondary rays (2—)3(—4), two-celled, much abbreviated, basal cell c. 75 μ long, c. 50 μ wide, ultimate cell c. 75 μ long, c. 30 μ wide, conical acuminate. *Fertile branchlets* contracted into dense heads of c. 3 cm diam., of which 1—5 are produced in the axils of the whorls of sterile branchlets only, sessile, branchlets 4—6 in a whorl, usually 1—2 times furcate, primary rays c. 375 μ long, secondary rays 1—3, c. 225 μ long, tertiary rays, if any, (1—)3 (—4), two-celled, basal cell c. 270 μ long, c. 80 μ wide, ultimate cell c. 75 μ long, c. 30 μ wide, destitute of mucous envelopment. *Dactyls* (1—)3(—4), two-celled; basal dactylous cell of the sterile branchlets tapering into the conical and strongly acuminate ultimate cell; basal

dactylous cell of the fertile branchlets rounded at the apex, therefore proportionally being much wider than the more allantoid ultimate cell. The length and the diam. of the inferior cell of the dactyls is much larger in the fertile branchlets than in the sterile ones. ♂ and ♀ *gametangia* sessile, together at all free nodes, frequently lacking at the ultimate one. *Antheridia* solitary, terminal, earlier ripe than oogonia, 220—270 μ in diam. *Oogonia* solitary or geminate, seldom triple, lateral, in not fully mature specimens 330—370 μ long, c. 300 μ wide; *spiral-cells* showing 7 convolutions; *coronula* 45 μ high, 30 μ wide at base, persistent; *oospore* (only one seen in the Java specimen) bright-brown, 270 (290—320) μ long, 255 (250—300) μ wide, with 6 broad ridges; *outer membrane* transparent, reticulate.

JAVA: Batavia, Batavia, III, no year, no collector's name (JUNGHUHN?), ex. herb. VAN DEN BOSCH in (B, L), *type* of *N. axillaris* var. *javanica* in (L).

Remarks. The features of *N. axillaris* are the fertile heads being always axillary produced and never terminal, and the length of the oospore varying between 270 and 320 μ. These characters alone seemed to BRAUN important enough to separate this species from *N. translucens* [1]) and *N. brachyteles*, both recorded from Europe and Africa, which come very near to it also in other respects. Two other species which are hardly different from these species have been described by T. F. ALLEN, viz. *N. Morongii* (1887, p. 214) from Nantucket (N. Americ.) and *N. sublucens* (1895, p. 70) from Japan. However, the last four species have the fertile heads not only axillary placed but also terminally. Having studied a great number of specimens, I felt inclined to include these four species, as well as *N. axillaris*, as varieties into one single species, for which the name *translucens* would be the valid one. However, a final decision in this matter has to be postponed until the type specimens have been checked.

I have dropped var. *javanica*. The habit of the variety should be a little more delicate and the oospores a little smaller. The type and the specimens extant in (B) and (L), however, do not show any essential difference in the size of the ripe oospores, and as the habit is also fairly robust (the stem-diam. is 1000 μ) I consider them identic.

With the naked eye *N. axillaris* seems very much like *N. acuminata*, with which it is frequently growing together, but it is microscopically at once distinghuished by its two-celled dactyls.

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[1]) Cf. also MIGULA (1897, p. 44), who states, in contradistinction to other authors, that the oospores of *N. translucens* are 260—290 μ long and 240—270 μ wide, thus having the same dimensions as *N. axillaris*.

Ecology. This robust, transparent and in a dried state shining plant occurs in ponds and stagnant pools, usually together with dense masses of *N. acuminata*. In India it is only collected in the rainy season.

Distribution. Between 30° N. and 70° S.; Asia, Malaysia: Java. Moreover in lit.: India: Gangetic Plain, Groves & Allen (1927, p. 336); Allen (1928, p. 55) — America, C. Am.: Mexico, Braun & Nordstedt (1882, p. 48), Guatemala, Nordstedt (1888, p. 182); Cuba, Nordstedt (1888, p. 182), Groves (1911, p. 34); Porto Rico, Nordstedt (1888, p. 194), Groves (1911, p. 34); Nordstedt (1889, p. 9); S. Am.: Venezuela, Braun (1858, p. 356), Nordstedt (1889, p. 9).

10. **Nitella bipartita** Filarszky in Arch. f. Hydrobiol. 1934, Suppl. Bd. 12, Trop. Binnengew. Bd. 4, p. 706; id. in Math. u. Naturw. Anz. Ungar. Akad. Wiss. 52, 1935, p. 468 (*nom. tant.*).

Illustrations. Filarszky, *l. c.* 1934, figs. 1—2; the pres. paper, figs. 1*a*—*c*.

Plant monoecious, thin, flexible, 4—6 cm high, densely overgrown with epiphytes. *Stem* slender, 450—675 μ in diam. *Internodes* in the lower parts of the plants 1—1½ times the length of the branchlets; in the upper parts 2—5 times. *Sterile branchlets* 5—6 in a whorl, constantly twice furcate, up to 2 cm long; primary rays usually half as long as the entire branchlet, in the lower parts still more; secondary rays 3—4; tertiary rays (dactyls) 2—3. *Fertile branchlets* (5—)6(—7) in a whorl, up to 0.5 cm long, contracted into heads, constantly two times furcate, not enveloped in mucus; primary rays c. 0.5 cm long; secondary rays 3—5; tertiary rays (dactyls) 2—4. *Dactyls* 2—4, very uniform in length, constantly two-celled, basal cell large, c. 1200 μ long, c. 180 μ wide, cylindrical, rounded at apex; ultimate cell conical, sometimes a little incurved, c. 105 μ long, c. 60 μ wide at base. ♂ and ♀ *gametangia* together at all and the same free branchlet-nodes, sessile. *Antheridia* solitary, terminal, earlier ripe than the oogonia, therefore usually only visible at the young nodes, c. 270 μ in diam. *Oogonia* solitary, not surrounded by a mucous cloud, lateral, 462—534 μ long (incl. coronula), 312—356 μ wide; *spiral-cells* showing 6—7 convolutions; *coronula* c. 89 μ high, 105—134 μ wide at base, cell-series of the upper row somewhat shorter than those of the lower row; *oospores* black, c. 213 μ long, c. 267 μ wide, with 5—6 indistinct ridges; *outer membrane* provided with scattered tubercles on a granulate background.

Sumatra: Palembang, Ranau, rice-field at the border of Lake Ranau, 560 m alt., 6 II 1929, German. Limnol. Sunda Exped. RSaβ (Bu-Mus), *type*.

JAVA: Buitenzorg, Buitenzorg, in rice-fields near the Tjisadani, 1929, VAN STEENIS s.n. (Bz).

Remarks. *Nitella bipartita* is at once recognizable by its uniformously two-furcate branchlets. FILARSZKY states (1934, p. 706) that it has the habit of *N. Leibergii*, but as the type consists of some small fragments only this cannot be ascertained. FILARSZKY writes (*l. c.* p. 706): "Trocken- u. Formol-Material", but here a mistake must have been made. The dried specimens, preserved in two separate covers, both labelled by Dr FILARSZKY himself "*N. bipartita* F." unmistakebly belong to *Chara hydropitys* var. *indica*. The formalin material, on the other hand, is not dated 27 I 1929 as is published, but 6 II 1929, and is mixed up with *N. acuminata*. On account of these facts there remain but very small fragments from the type proper.

Another inconsistency is found in the description, in which FILARSZKY says: "Die fertilen Strahlen bilden reine Köpfchen (*Diffusae*)". The condition of the fertile whorls being contracted has to be named "*Congestae*". The few branchlet-whorls extant in the formalin material are not much contracted and this is the case too in FILARSZKY's little accurate fig. 1.

From Buitenzorg I borrowed a specimen, collected by VAN STEENIS, which in the lower parts is quite identic with the fragments of the type and in the upper parts shows a remarkable similarity in habit to pl. 71 of *N. muthnatae* described by T. F. ALLEN from the Fiji Islands (1887, p. 211). The branchlets of this plant are in the upper parts contracted into dense rounded heads, whereas in the lower parts they are diffuse. I think that in the type of *bipartita* only the lower branchlets are preserved and therefore I have given above an emendation of the description of that species on account of the Buitenzorg plant. *N. muthnatae* differs from *N. bipartita* in characters of minor importance, i. e. smaller gametangia, which are only developed at the ultimate free node. As I did not see the type of *N. muthnatae* I cannot decide to the identity of both species. *N. Leibergii* has once and twice furcate branchlets and smaller oogonia. Characteristics for *N. bipartita* are the long axillary branchlets with dense clusters of fertile whorls and the NORDSTEDT-markings.

Ecology. *N. bipartita* is a small graceful plant, frequently densely covered with clay and epiphytic green algae. It grows in clusters in rice-fields, mixed up with *N. acuminata*.

Distribution. Between 5° N. and 7° S.; ASIA, Malaysia: Sumatra, Java.

11. Nitella pseudoflabellata A. BRAUN apud NORDSTEDT in Act. Univ. Lund. 16, 1880, p. 6; id. in VON MARTENS, Die Preuss. Exped. n. O.-Asien, Bot. Th., 1866, p. 143 (*nom. tant.*) — *Nitella mucosa*; *Nitella pseudoflabellata* f. *australiana*, f. *mucosa*, var. *imperialis*, var. *ramuscula*, var. *ramuscula* f. *testa-glabra*; cf. varieties.

Plant monoecious, elongated, 20—30 cm high, dark-green, sometimes brown by covering with clay. *Stem* slender to moderately stout, 385—700 μ in diam. *Internodes* 1—3 times the length of the branchlets. *Sterile branchlets* 6—8 in a whorl, frequently only forming the lower whorls, somewhat more rigid and divergent than the fertile branchlets, (2—)3(—4) times furcate, c. 2.5 cm long, primary rays $^1/_2$—$^2/_3$ the length of the entire branchlet, secondary rays (4—)5(—7), tertiary rays 5—6, sometimes some of them divided into 4—6 quaternary rays, very rarely 2—3 quinary rays occur. *Fertile branchlets* 5—7 in a whorl, 1.2—1.7 cm long, in the lower and older whorls similar to the sterile ones, in the younger upper whorls more compact, forming loose heads, 3(—4) times furcate, primary rays up to 1 cm long; secondary rays 5—7 which are usually all again furcate into (4—)5(—6) tertiary rays, of which sometimes some give rise to 4 quaternary rays, exceeding the tertiary rays in length; young fertile whorls enveloped in mucus or mucus not present at all. *Dactyls* 4—5, of equal length, very uniform, two-celled, basal cell very large, 500—800 μ long, 95—120 μ wide, cylindrical with a rounded distal end, ultimate cell usually conical, sometimes awl-shaped, 40—80 μ long, 30—40 μ wide at base. ♂ and ♀ *gametangia* at the same free nodes, but, since the antheridia are earlier ripe, the oogonia are frequently seen alone; usually lacking at the first node. *Antheridia* solitary, strictly terminal on a basal node-cell, sometimes hardly visible, sometimes 60 μ high, 200—300 μ in diam. *Oogonia* solitary, on a basal node-cell, which is less high than the antheridial one, viz. c. 45 μ, 375—465 μ long (incl. coronula), 320—355 μ wide; *spiral-cells* showing 7—8 convolutions; *coronula* small, 30—55 μ high, 45—60 μ wide at base, individual cells convergent, persistent; *oospores* golden to dark chestnut-brown, 290—350 μ long, 235—270 μ wide, with 6—7 ridges; *outer membrane* thin, light-brown, translucent, tuberculate with little, more or less closely set warts, on a dotted or granulate background, or being somewhat spongy.

Remarks. *Nitella pseudoflabellata* very much resembles *N. mucronata*, but there are some characters by which it can be recognized at once: 1. the dactyls are always two-celled and of equal length; 2. the number of rays at the second and ultimate furcations is 4 or

more; 3. the primary ray is elongated and as long as, or longer than half the length of the entire branchlet; 4. the dactyls are always longer than the secondary and tertiary rays.

AGHARKAR & KUNDU (1937, p. 7) regard the absence of gametangia in the first furcations of the branchlets as another characteristic for *N. pseudoflabellata*. In the type, however, I noticed gametangia at the first furcation.

As is pointed out under *N. flagelliformis* that species and *N. pseudoflabellata* were formerly confounded (cf. BRAUN & NORDSTEDT, 1882, p. 54). Some specimens, which unmistakebly belong to *N. pseudoflabellata* being monoecious, may therefore bear on the label the name of *flagelliformis* written by BRAUN,

It may not be superfluous, I think, to give a review of the history of *N. pseudoflabellata*. The name *pseudoflabellata* was published by BRAUN in 1866 (p. 143) concerning a plant collected near Loemar in W. Borneo; a description, however, was only published in the "Fragmente" of 1882 (p. 54). Here, BRAUN mentions gymnocephalous plants from four localities and moreover the Loemar plant as belonging to a newly created variety *mutila*.

In the meantime NORDSTEDT described two plants from New Zealand (1880, p. 16) which he named *N. pseudoflabellata* forma *mucosa* on account of the fertile whorls being enveloped in mucus. According to the International Botanical Rules one of these plants is now the type of *N. pseudoflabellata* and not the gymnocephalous plant from Loemar.

In an article on the *Charophyta* of Ceylon, GROVES (1922, p. 100), gave NORDSTEDT's form *mucosa* specific rank under the name of *N. mucosa*, though it is obvious from the above cited notes that this name is invalid.

In completing this review I must still add, that NORDSTEDT distinguishes in 1889 (p. 24) a new form, *australiana*, on account of a deviating decoration of the oospore membrane, and T. F. ALLEN (1898, p. 77) distinguished two more new varieties both occurring in Japan, one with the fertile heads enveloped in mucus, i. e. *imperialis* and one without such a mucous cloud, i. e. *ramuscula*.

Surveying the whole it is in full agreement with the International Botanical Rules that the plants with the fertile whorls enveloped in mucus must bear the name *pseudoflabellata*, if they are to be considered a separate species at all. However, I cannot share this opinion as the specific importance of the features: mucus or no mucus, is a too insignificant one, and that of the decoration of the oospore mem-

brane likewise. I therefore unite the gloeocephalous plants into the variety *mucosa,* and the gymnocephalous ones into another variety, for which the name *mutila* is the correct one, as there is no essential difference between the plant from Loemar and the other specimens cited in the "Fragmente" (cf. below under the var. *mutila*).

Ecology. Cf. under the varieties.

Distribution. Between 35° N. and 44° S., occurring in Japan, China, India (incl. Ceylon), Indo-China, Malaysia, various parts of Australia, New Caledonia and New Zealand.

var. α **mucosa** (NORDSTEDT) BAILEY, Compreh. Cat. Queensl. Pl., 1909, p. 678 [1]) — *Nitella pseudoflabellata* A. BR. f. *mucosa* NORDSTEDT in Act. Univ. Lund. 16, 1880, p. 16; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 12, 56; T. F. ALLEN, Charac. America 1, 1888, p. 46 (*nom. tant.*); NORDSTEDT in Act. Univ. Lund. 25, 1889, pp. 10, 11, 25; id. in Proc. Roy. Soc. Vict., N. S., 31, 1918, p. 3 (*nom. tant.*) — *Nitella pseudoflabellata* A. BR. ex RIDLEY in Journ. Straits Branch R. A. Soc. 80, 1919, p. 163 — *Nitella mucosa* (NORDSTEDT) J. GROVES in Journ. Linn. Soc., Bot., 46, 1922, p. 100; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 361, 366; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, pp. 41, 44. — ? *Nitella pseudoflabellata* A. BR. var. *imperialis* T. F. ALLEN in Bull. Torr. Bot. Cl. 25, 1898, p. 78.

Illustrations. NORDSTEDT in Act. Univ. Lund. 25, 1889, f. 12; T. F. ALLEN, Contrib. to Japan. Charac. 1898, unnumbered pl. (var. *imperialis*); the pres. paper, f. 7*a*.

Plants having the fertile whorls enveloped in mucus. *Outer membrane* tuberculate with small closely set warts of c. 2 μ height, in more or less distinct rows which are perpendicular to the ridges; if seen from above and at low magnifications it looks granulate.

MALAY PENINSULA: Malacca, Kuala Lumpur, in a pond, 23 II 1919, BURKILL, St. of Selangor 4427 (Si); ibid., Galang, in ditches, 1899, RIDLEY 10827 (K, Si); Singapore, Singapore, Cluny lake, I 1923, HOLTTUM s.n. (no 10016?) (Si); ibid., Gardens lake, VI 1937, PESTAVA s.n. (L).

SUMATRA: Atjeh & Depend., Perapat, in a quiet bight of Lake Toba, rooting at a depth of c. 2 m, 906 m alt., 27 V 1923, LÖRZING 10115 (Bz).

JAVA: Pekalongan, Tegalpandjang, G. Djaja, 2041 m alt., in a puddle, 18 V 1931, VAN STEENIS 4962b (Bz); Priangan, G. Papandajan, V 1931, VAN STEENIS 4962a (Bz).

Remarks. Both characteristics of this variety are more or less dubious: the presence of mucus can only be stated with certainty

[1]) BAILEY writes "*muscosa*" instead of *mucosa*.

in young, fresh plants or when they are preserved in fluid, and the opinions concerning the decoration of the membrane differ more or less. NORDSTEDT writes (1889, p. 10) that the membrane is closely set with prickles of 2—6 μ length and refers to the membrane of *N. capitata* where the warts are hyaline and only visible from the side. When seen from above the membrane of var. *mucosa* seems to be granulate. Now GROVES described in his Ceylon plants (1922, p. 100) the outer coloured membrane as granulate. According to GROVES & ALLEN (1935, p. 45) the membrane was drawn by BULLOCK WEBSTER, who depicts the type as tuberculate with a tendency to form lines.

The gloeocephalous var. *imperialis* of T. F. ALLEN (1898, p. 78) has the membrane covered with a close felt of fine hairs.

In agreement with the foregoing, the opinions differ about the membrane of var. *mutila*. NORDSTEDT (1889, p. 10) quoted the membrane as somewhat spongy, but in the same publication (p. 24) this author distinguishes a form *australiana* having a somewhat spongy membrane, but closely set with little prickles of c. 1.5—3 μ length. G. O. ALLEN (1937, p. 155) remarks about the spongy membrane that this is no doubt a case of felting which obscures the true decoration. GROVES in his study on the Ceylon plants (1922, p. 99) describes the membrane as imperfectly reticulate with about 6 large meshes between the ridges. In GROVES & ALLEN (1935, p. 45) the membrane is cited as being granulate. T. F. ALLEN distinguishes in his gymnocephalous var. *ramuscula* (1898, p. 79) two forms, one with the membrane marked by faint granules in very low relief, the tops of the ridges being dotted with more prominent granules irregularly disposed, almost as if toothed, and another form distinguished as f. *testa-glabra* with the coloured membrane perfectly smooth.

In this connection I studied the "NORDSTEDT-markings" of the two varieties, and I must state that in both varieties a granulate membrane may occur. Fig. 7*e* of this paper shows the membrane of the Java specimen of herb. VAN DEN BOSCH, but it is not different from those of the specimens of Malay Peninsula, RIDLEY 10827 and HOLTTUM 10016?, which belong to var. *mucosa*. The type specimen of var. *mutila* (Loemar) is represented by figs. 7*b* and *c*, which show small, more or less scattered tubercles of c. 1 μ height on a granulate or dotted background. In the specimens from Amboina and Chittagong (Bengal) the tubercles have the shape of press-buttons (cf. f. 7*d*).

As the type of var. *mucosa* was not at my disposal, I studied the specimens from Malay Peninsula determined by GROVES as *N. mucosa*.

As already stated these specimens have a granulate membrane. Fig. 7*a* depicts the outer membrane of the Java specimen collected by VAN STEENIS (4962a), it shows closely set warts of c. 2 μ length which are perpendicular to the ridges.

Ecology. In lakes, creeks and pools, immediately below the surface of the water. Ripe oospores are found from January to May.

Distribution. Between 45° N. and 44° S.; ASIA, Malaysia: Malay Peninsula, Sumatra, Java. Moreover in lit.: ? Japan, T. F. ALLEN (1898, p. 78); Ceylon, GROVES (1922, p. 100) — AUSTRALIA, Queensland, BAILEY (1909, p. 678), GROVES & ALLEN (1937, p. 44); Victoria, NORDSTEDT (1918, p. 3); New Zealand, NORDSTEDT (1880, p. 16; 1889, p. 25).

var. β **mutila** A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 56 — *Nitella pseudoflabellata* A. BR. ap. NORDSTEDT in Act. Univ. Lund. 16, 1880, p. 6; BRAUN in VON MARTENS, Die Preuss. Exped. n. O.-Asien, Bot. Th., 1866, p. 143 (*nom. tant.*); id. in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 12, 54; T. F. ALLEN, Charac. America 1, 1888, p. 45 (*nom. tant.*); NORDSTEDT in Act. Univ. Lund. 25, 1889, p. 10; DE WILDEMAN, Prodr. Fl. Alg. Ind. Néerl., 1897, p. 31; id., Suppl. e. Tabl. Stat., 1898, p. 98; T. F. ALLEN in Bull. Torr. Bot. Cl. 25, 1898, p. 77; DE WILDEMAN, Alg. Fl. Buitenz., 1900, p. 377; NORDSTEDT in Proc. Roy. Soc. Victoria, N. S., 31, 1918, p. 3 (*nom. tant.*); J. GROVES in Journ. Linn. Soc., Bot., 46, 1922, p. 98; id., id., 1924, pp. 361, 366; MIGULA in Hedwigia 70, 1930, p. 212; FILARSZKY in Arch. Hydrobiol., 1934, Suppl. Bd. 12, Trop. Binnengew., Bd. 4, p. 713; GROVES & ALLEN in Proc. Roy. Soc. Queensl., 46, 1935, pp. 41, 44; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, pp. 3, 6 — ? *Nitella pseudoflabellata* A. BR. ap. NORDSTEDT f. *australiana* NORDSTEDT in Act. Univ. Lund. 25, 1889, p. 24 — ? *Nitella pseudoflabellata* A. BR. ap. NORDST. var. *ramuscula* T. F. ALLEN in Bull. Torr. Bot. Cl. 25, 1898, p. 78 — *Nitella pseudoflabellata* A. BR. ap. NORDST. var. *ramuscula* T. F. ALLEN f. *testa-glabra* T. F. ALLEN in Bull. Torr. Bot. Cl. 25, 1898, p. 79 — *Nitella* sp. nov.? G. VON MARTENS in Proc. Asiat. Soc. Bengal, 1870, p. 183.

Illustrations. T. F. ALLEN, Contrib. to Japan. Charac., 1898, two unnumbered pl. (var. *ramuscula*); AGHARKAR & KUNDU in Journ. Dep. Sci., N. S., 1, 1937, pl. 3, figs. 1—5; the pres. paper, figs. 7*b*—*e*.

Plants having the fertile whorls not surrounded by mucus. *Oospore membrane* showing scattered tubercles of c. 1 μ height on a dotted or granulate background.

INDIA: Ceylon, Taprobane, along the road between Kadenama and Kandyducentem, 24 I 1862, Prussian Exped. to E.-Asia, WICHURA 2700 (B); E.-Bengal, Chittagong, no date, HOOKER & THOMSON s.n. (B).

INDO-CHINA: Tonkin, rapid in the river between Loch-Ouan and Ououbi, 2 XI 1885, BALANSA 17 (K).

MALAY PENINSULA: Pahang, Telok Sisik, Kuantan, in a pool of brown peaty water, 4 XII 1924, BURKILL, Singapore field no 17347 (Si).

SUMATRA: Tapanoeli, in rice-fields in the vicinity of Lake Toba, 1100 m alt., XII, no year and collector's name (probably JUNGHUHN) (L); ibid., in a large pool on the moor of Hoetagindjang, south of Lake Toba, 1500 m alt., 3 IV 1929, German Limnol. Sunda Exped. TH 1 and TH 13 (Bu-Mus), badly preserved, therefore identification not certain.

JAVA: Batavia, Batavia, no date, JUNGHUHN s.n. (B); id., near Batavia and Anjol, at the border of a swamp, III, no year, JUNGHUHN s.n. (L); Pasarminggoe, X 1930, Geneesk. Dienst v. Malaria Bestrijd. s.n. (Bz); Priangan, in a ditch along the road to G. Megamendoeng, 1350 m alt., no date, KURZ 123 (B, K); ibid., W.-Priangan, Sitoe Goenoeng, c. 1000 m alt., in the lake, 19 XI 1933, VAN STEENIS 5683 (Bz); ibid., Telaga Patengan, in the lake, no date, JUNGHUHN s.n., herb. VAN DEN BOSCH (B, L).

BORNEO: W. Division, Loemar, between Montrado and Sambas, 30 III 1863, E. VON MARTENS s.n. (B), *type* of *N. pseudoflabellata* var. *mutila*.

AMBOINA: Amboina, in the lake of the Government's garden, 1828, ZIPPELIUS s.n. (L), mixed with *Chara corallina*.

NEW GUINEA: Papua, at base of the Rouna falls, in a pool on exposed rock under continual spray, 270 m. alt., 27 V 1935, CARR 12380 (B, L).

Remarks. The only peculiarity of variety *mutila* is the absence of mucus surrounding the fertile whorls. BRAUN established this variety on account of its being not more than twice furcate. After my having studied the type I stated that many of the branchlets are three and even four times divided. Therefore, these plants are quite identic with those from Java, China and Bengal cited in the "Fragmente" (1882, pp. 54—56). It is much variable in habit.

The decoration of the oospore membrane is discussed under var. *mucosa*.

Ecology. In lakes, rivers, pools, rice-fields, swamps, and ditches, usually not together with other *Charophyta*; only *Chara corallina* and *C. Braunii* were found growing together with it. The label of the specimen from the Toba lake has, in addition, the following notes: temp. of surface 27°.5 C., pH 5.5, conductivity $0.06 \cdot 10^{-4}$. Specimens with ripe oospores are found from October to June. It probably prefers mountainous areas.

Distribution. Between 35° N. and 38° S.; ASIA, India; Indo-China; Malaysia: Malay Peninsula, Sumatra, Java, Borneo, Amboina, New Guinea. Moreover in lit.: China, BRAUN &

NORDSTEDT (1882, p. 55); Japan, T. F. ALLEN (1898, p. 79, var. *ramuscula*), MIGULA (1930, p. 212) — AUSTRALIA, Queensland, NORDSTEDT (1889, p. 24, f. *australiana*), BAILEY (1909, p. 6); GROVES & ALLEN (1937, p. 44); Victoria, NORDSTEDT (1918, p. 3).

12. Nitella moniliformis ZANEV., nov. spec.

Illustrations. The pres. paper, figs. 2*a*—*c*.

Planta monoica, gracilis, humilis, moniliformis, brunneo-viridis, ad 15 cm alta. *Caulis* tenuis, 150—300 μ in diam. *Internodia* quam ramuli 1—2-plo longiora. *Verticillorum ramuli* steriles fertilibus similes, capita formantes, c. 0.7 cm diam., plerumque 4-, interdum 3- ad 5-furcati, 0.5 cm longi; radii primarii 6—7, longitudine ½ totius ramuli; radii secundarii 5—6; radii tertiarii 5—6; radii quaternarii 4—5; radii quintarii (dactyli) 3—5. *Dactyli* plerumque 3—5, plus minusve aequales, bicellulati, cellula inferior 250—530 μ longa, 35—55 μ lata, cylindrica, apice rotundata, cellula superior acuminata, 35—70 μ longa, basi 8—17 μ lata. ♂ et ♀ *gametangia* ad omnes furcationes posita, haud muco circumfusa. *Antheridia* solitaria, terminalia, c. 180 μ diam. *Oogonia* 1—3 aggregata, ad nodos liberos posita, 240—270 μ longa (coronula inclusa), 204—235 μ lata, striis (5—)6; *coronula* persistens, connivens, 50—60 μ alta, basi 65—90 μ lata; *oosporae* aureo-brunneae, 180—225 μ longae, 155—195 μ latae, striis (4—)5; oosporae *membrana* tuberculata.

Plant monoecious, graceful, delicate, remarkably moniliform, up to 15 cm high, brownish green, not at all incrusted, in a dried state extremely felty. *Stem* very slender, 150—250 μ in diam. *Internodes* 1—2 times as long as the branchlets. *Sterile* and *fertile* branchlets similar, forming roundish dense heads of c. 0.7 cm diam., 6—7 in a whorl, c. 0.5 cm long, frequently four, sometimes three to five times furcate; primary rays half as long as the entire branchlet; secondary rays 5—6, which are frequently all forked into 5—6 tertiary rays; these are all again divided into 4—5 quaternary rays, of which one or two have a fourth furcation with 3—5 uniform quinary rays. *Dactyls* 3—5, always two-celled, rigid, basal cell 250—530 μ long, 35—55 μ wide, cylindrical, rounded at the apex, upper cell conical, somewhat curved, 35—70 μ long, 8—17 μ wide at base. ♂ and ♀ *gametangia* sessile, at all free nodes of the branchlets, not enveloped in a mucous cloud. *Antheridia* solitary, terminal, c. 180 μ in diam., earlier ripe than oogonia. *Oogonia* 1—3 together, when young globular, 240—270 μ long (incl. coronula), 204—235 μ wide; *spiral-cells* showing (5—)6 convolutions; *coronula* persistent, 50—60 μ high, 65—90 μ wide at

base, individual cells strongly connivent; *oospores* bright golden-brown, 180—225 μ long, 155—195 μ wide, with (4—)5 ridges; *outer membrane* tuberculate, the bases of the rather large tubercles being joined by means of small threads.

JAVA: W. Priangan, Tjitibo, Tjidadap, 1000 m alt., abundant in rice-fields and swamps, 21 II 1917, BAKHUIZEN VAN DEN BRINK 2586 (Bz), *type*.

Remarks. This small, graceful, and when dried, felty species, is at once recognized by its moniliformous habit. Its most striking features are the aggregated oogonia and the tuberculate oospore membrane, which were not yet known from any monoecious species of the strictly bicellulate macrodactylous group. *N. moniliformis* resembles somewhat *N. batrachosperma* and small forms of *N. tenuissima* (var. *byssoides*), but differs from both in the above cited characters, and, moreover, in the higher degree of furcation of the branchlets and in the fertile first node respectively.

Ecology. "Below the surface" of the water, in "rice-fields" and "swamps", are notes given on the herbarium label. Ripe oospores are found in February.

Distribution. On 7° S.; ASIA, Malaysia: Java.

13. **Nitella batrachosperma**[1]) (REICHENBACH) A. BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10, 1849, p. 10 (*nom. tant.*); id. in COHN's Krypt. Fl. Schles., 1876, p. 400; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 12, 66; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 362, 367; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 597; id. in Journ. Ind. Bot. Soc. 7, 1928, p. 58, text-fig. 6; PAL in Journ. Burma Res. Soc. 18, 1929, p. 113 (*nom. tant.*); id. in Journ. Linn. Soc., Bot., 49, 1932, pp. 64, 71. — *Chara batrachosperma* REICHENBACH, Iconogr. Bot. 8, 1830, pl. 794; id., Fl. Germ. exsicc., 1830, p. 148 — *Nitella confervacea* A. BRAUN, Consp. syst. Charac. europ., 1867, p. 2; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 12, 64; HY in Bull. Soc. bot. France 52, 1905, p. 94.

Plant monoecious, extremely small and delicate, c. 5 cm high. *Internodes* 1—4 times the length of the branchlets. *Sterile* and *fertile branchlets* similar, 8 in a whorl, twice, occasionally thrice furcate; secondary rays 4—6. *Dactyls* 3—7, uniformly two-celled, frequently more than half the length of the entire branchlet. ♂ and ♀ *gametangia* at the first and occasionally at the second branchlet-node, sometimes enveloped in mucus, solitary. *Antheridia* 175—200 μ in diam. *Oospores* dull yellow-brown, 225—300 μ long, with 6—8 ridges. *Membrane* at first finely granulate, subsequently reticulate.

Remarks. Different from the closely allied *Nitella gracilis* and *N. tenuissima*

[1]) The literature here mentioned concerns only the area under discussion; an extensive list of publications, illustrations and synonyms (not seen by the author) is to be found in MIGULA (1897, pp. 182, 184) and in GROVES & BULLOCK WEBSTER (1920, p. 124).

by the uniformly two-celled dactyls, and from *N. moniliformis* and *N. pseudoflabellata* by the less furcate branchlets. No Malaysian specimens examined.

E c o l o g y. Occurring in shallow pools on very fine mud and on decaying filamentous algae.

D i s t r i b u t i o n. Between 43° N. and 30° S.; EUROPE — ASIA, I n d i a: Gangetic Plain, GROVES (1924, p. 367), G. O. ALLEN (1925, p. 597); Burma, PAL (1932, p. 71); J a p a n — N. AMERICA — AUSTRALIA.

14. Nitella dictyosperma H. & J. GROVES in Journ. Linn. Soc., Bot., 33, 1898, p. 324, pl. 19; id. in URBAN, Symb. Antill. 7, 1911, pp. 30, 35; PAL in Journ. Linn. Soc., Bot., 49, 1932, pp. 64, 74.

Plant monoecious, slender. *Internodes* somewhat exceeding the branchlets in length. *Branchlets* 6 in a whorl; *sterile branchlets* twice furcate, secondary rays 3; *fertile branchlets* 2—3 times furcate, secondary rays 3—4. *Dactyls* 3, usually one of them abbreviated; two-celled. ♂ and ♀ *gametangia* together at the second and third branchlet-nodes, solitary, not enveloped in mucus. *Antheridia* 270—300 μ in diam. *Oospores* brown, c. 280 μ long, with 6 ridges. *Membrane* reticulate.

R e m a r k s. Akin to *Nitella oligospira*, but different in having all dactyls elongated except occasionally one. No specimens examined.

E c o l o g y. In ponds and canals.

D i s t r i b u t i o n. Between 17° N. and 15° N.; ASIA, I n d i a: Burma — AMERICA, C. A m.: Antigua, Guadeloupe.

15. Nitella flagellifera GROVES & ALLEN in Journ. Bot. 65, 1927, p. 337; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 59, pl. 4.

Plant monoecious, medium-sized. *Internodes* not much longer than the branchlets. *Sterile* and *fertile* branchlets similar, 6 in a whorl, thrice furcate, up to 8 cm long; secondary rays 6. At the first two branchlet-nodes an accessory fertile branchlet is produced. *Dactyls* 3—4, two-celled. ♂ and ♀ *gametangia* together at the second and third branchlet-nodes, not at the first one or at the base of the whorls, solitary, not enveloped in mucus. *Antheridia* c. 250 μ in diam. *Oospores* dull orange-yellow, c. 325 μ long, with 7 ridges. *Membrane* imperfectly reticulate.

R e m a r k s. The outstanding feature of this species is the production of a separate little fertile branchlet at the first and second branchlet-node of the stem-whorls. No specimens examined.

E c o l o g y. In a pond, in the early cold season.

D i s t r i b u t i o n. 30° N.; ASIA, I n d i a: Gangetic Plain.

16. Nitella patula GROVES & ALLEN in Journ. Bot. 65, 1927, p. 338; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 59.

Plant monoecious, rather large. *Sterile* and *fertile branchlets* similar, 6 in a whorl, 3—4 times furcate; secondary rays 6—7. *Dactyls* 2—3, two-celled. ♂ and ♀ *gametangia* together at the second and third branchlet-nodes, solitary, not enveloped in mucus. *Antheridia* c. 275 μ in diam. *Oospores* light-brown, c. 375 μ long, with 7 ridges. *Membrane* finely and regularly granulate.

R e m a r k s. Distinguishable from the closely allied *Nitella furcata* by having solitary oogonia and a larger number of furcations, and from *N. oligospira* by having a granulate oospore membrane. No specimens examined.

Ecology. In the open middle portion of a small pond surrounded by dense masses of rushes, and drying up rapidly between the rainy and cold seasons.

Distribution. 30° N.; ASIA, India: Gangetic Plain.

17. **Nitella leptodactyla** J. GROVES in Journ. Linn. Soc., Bot., 46, 1922, p. 99, pl. 6; id. in Journ. Linn. Soc., Bot., 48, 1928, p. 132 (var. *megaspora*); G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 57; ZANEVELD in Blumea 3, 1939, p. 381 (var. *megaspora*).

Plant monoecious, slender, up to 30 cm high. *Internodes* 2—5 times the length of the branchlets. *Sterile* and *fertile branchlets* similar, 6—7 in a whorl, 2—4 times furcate; secondary rays 7. *Dactyls* 3—5, two-celled. ♂ and ♀ *gametangia* together at the second and third branchlet-nodes, sometimes enveloped in mucus, solitary. *Antheridia* c. 225 μ in diam. *Oospores* red-brownish black, c. 228 μ long, with 7—8 ridges. *Membrane* granulate.

Remarks. Characterized by the sterile first node, the granulate oospore membrane and the number of secondary rays, and thereby distinguishable from *N. pseudoflabellata* and its near allies. The var. *megaspora* was collected in Madagascar only and has oospores of 275—400 μ length. No specimens examined.

Ecology. In a pond, in November.

Distribution. Between 30° N. and 20° S.; ASIA, India: Gangetic Plain; Ceylon — AFRICA, Madagascar.

18. **Nitella Wattii** J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 361, pl. 36.

Plant monoecious, slender, c. 20 cm high. *Internodes* 1—3 times the length of the branchlets. *Sterile* and *fertile branchlets* similar, 6—7 in a whorl, 3—4 times furcate; secondary rays 6—7. *Dactyls* 5—6, uniformly two-celled. ♂ and ♀ *gametangia* together at the second and third branchlet-nodes, solitary, enveloped in mucus. *Antheridia* c. 225 μ in diam. *Oospores* chestnut-brown, c. 200—225 μ long, with 7—8 ridges. *Membrane* with vermiformous decoration.

Remarks. The outstanding features of this species are the unequal length of the branchlets in the same whorl, and the much abbreviated penultimate rays, surpassed by the clusters of dactyls. No specimens examined.

Ecology. Unknown.

Distribution. On c. 25° N.; ASIA, India: Gangetic Plain.

19. **Nitella oligospira** A. BRAUN in Monatsber. Kön. Akad. Wiss. Berlin, 1858, p. 357; id. in ZELLER in Journ. Roy. As. Soc. Bengal, 2, 1873, p. 193; id. in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 13, 67; T. F. ALLEN, Charac. America 1, 1888, p. 47 (*nom. tant.*); NORDSTEDT in Hedwigia 27, 1888, p. 194; id. in Act. Univ. Lund. 25, 1889, p. 11; id. in Proc. Roy. Soc. Vict., N. S., 31, 1918, p. 3 (*nom. tant.*); J. GROVES in Journ. Linn. Soc., Bot., 46, 1922, p. 100; id. in Journ. Linn. Soc., Bot., 46, 1924, pp. 362, 368; PAL in Journ. Burma Res. Soc. 18, 1929, p. 113 (*nom. tant.*); MIGULA in Hedwigia 70, 1930, p. 213; DIXIT in Journ. Ind. Bot. Soc., 10, 1931, p. 205; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S., 1, 1937, pp. 3, 7 — *Nitella oligospira* f. *australiana*, f. *genuina*, var. *australiensis*; *Nitella javanica;* cf. formae.

Illustrations. BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pl. 2, figs. 50—52; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, pl. 3, figs. 15—18.

Plant monoecious, greyish to bright-green, lax, c. 25 cm high. *Stem* rather slender to moderately stout, 320—380 μ in diam. *Internodes* 0.5—3 times the length of the branchlets. *Sterile branchlets* 6—7 in a whorl, c. 1.5 cm long, rigid, spreading, (2—)3(—4) times furcate; primary rays $^1/_2$—$^1/_3$ as long as the entire branchlet; secondary rays 4—5; tertiary rays 2—3 of which 1—2 are again forked with 1—3 quaternary rays. *Fertile branchlets* 5—7 in a whorl, tufted, 2.5—3 cm long, 4(—5) times furcate; primary rays $^1/_3$ the length of the branchlet; secondary rays 5—7; tertiary rays 3—4, most of them again furcate into 2—3 quaternary rays; sometimes 1—2 of these give rise to 1—2 quinary rays. *Dactyls* 1—3, two-celled, varying in length, some are very short, others very long, lower cell cylindrical, 45 μ wide, extremely variable in length, rounded or truncate at apex; ultimate cell conical, 55—130 μ long, 25—40 μ wide at base, acuminate. ♂ and ♀ *gametangia* sessile, at all and the same free nodes, the ultimate one sometimes excepted, viz. when all dactyls are abbreviated; not enveloped in a mucous cloud, solitary. *Antheridia*, terminal, 208 –310 μ in diam. *Oogonia* lateral, 384—560 μ long (incl. coronula), 365—460 μ wide; *spiral-cells* showing 7—8 convolutions; *coronula* 30—40 μ high, 27—38 μ wide at base, persistent, the cells of both rows equal in length; *oospores* light-brown, 260—400 μ long, 215—365 μ wide, with 6—7 broad ridges; *membrane* reticulate.

Remarks. *Nitella oligospira* is a rather variable species especially with regard to the length of the dactyls, the furcation of the branchlets, and the size of the ripe oospores. Formerly BRAUN combined this and the nearly related species (cf. our key) under the name of *Nitella polyglochin sens. lat.* (1882, p. 13). The special features of *N. oligospira* are the solitary oogonia, the short, persistent coronula (the upper row of cells as high as the lower one), and the dactyls having proportionally few short cells. The ultimate node is not always sterile, as is mentioned by GROVES (1924, p. 362) in his key for the Indian *Charophyta*. In studying the types of the forms distinguished by BRAUN, it became obvious that this author used to classify a plant under this species, in all those cases, in which abbreviated dactyls, however few, were extant.

As will be seen below, I share BRAUN's opinion in distinguishing the forms *javanica* and *indica* although transitional specimens occur,

e. g. the Javanese plant from Madjapahit. The form *australiana* of NORDSTEDT has probably to be united with f. *indica*, and f. *genuina* of NORDSTEDT (which name was only published in the key of NORDSTEDT in the "Fragmente" — 1882, p. 13 — and in T. F. ALLEN's translation thereof — 1888, p. 47 —) with f. *javanica*, but not having seen the types I should prefer to reserve judgement. The variety *Wrightii*, also distinguished by BRAUN, is not mentioned in NORDSTEDT's key and from the descriptions it seems to occupy an intermediate position between f. *indica*, with which the size of the oospores agree, and f. *javanica*, with which it has in common the number of branchlet-furcations and the diameter of the stem.

Ecology. In small rivers, creeks, and holes in a small stream. Somewhat mountainous areas are preferred.

PAL (1932, p. 51) gives for the seasonal distribution in Burma the months November to March, in which period ripe oospores may be found. In Salsette (Bombay), according to DIXIT (1931, p. 205), ripe oospores are present from August to March. In Malaysia mature oospores were collected in July (cf. f. *javanica*), and immature ones in February and August (cf. f. *indica*).

Distribution. Between 35° N. and 28° S.; ASIA, India: India Deserta, Bengal, Ceylon; Pegu; Nicobar Islands; Malaysia: Malay Peninsula, Java, New Guinea, cf. forms. Moreover in lit.: Japan, MIGULA (1930, p. 213); ? China: Hongkong, ex GROVES (1911, p. 36); India: Assam, GROVES (1924, p. 368); Burma, PAL (1932, p. 75) — AMERICA, N. Am.: Texas, BRAUN & NORDSTEDT (1882, p. 70, var. *Wrightii*); ? Georgia, ex GROVES (1911, p. 36); C. Am.: Cuba, GROVES (1911, p. 36); Porto Rico, NORDSTEDT (1888, p. 194; 1889, p. 11), GROVES (1911, p. 36); S. Am.: Venezuela; Caracas, cf. f. *indica*, BRAUN (1858, p. 351); Brazil, cf. f. *indica* — AFRICA, Comoro Islands, BRAUN & NORDSTEDT (1882, p. 68, f. *genuina*) — AUSTRALIA, Queensland, cf. f. *indica*.

f. 1. **javanica** A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 13, 68; T. F. ALLEN, Charac. America 1, 1888, p. 47 (*nom. tant.*); NORDSTEDT in Act. Univ. Lund. 25, 1889, p. 11; DE WILDEMAN, Prodr. Flor. Alg. Ind. Néerland., 1897, p. 31; id., Suppl. et Tabl. Stat., 1899, p. 98; id., Alg. Flor. Buitenzorg, 1900, p. 375 — ? *Nitella oligospira* A. BR. f. *genuina* NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 13 (*nom. tant.*); T. F. ALLEN, Charac. America 1, 1880, p. 47 (*nom. tant.*) — *Nitella javanica* HASSKARL in herb. (B, Bz).

Illustrations. BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss.

Berlin, 1882, pl. 5, figs. 133—134; NORDSTEDT in Act. Univ. Lund. 25, 1889, f. 30, f. 31 (f. *genuina*); DE WILDEMAN, Alg. Flor. Buitenzorg, 1900, f. 140.

Plants rather slender. *Stem* up to c. 500 μ in diam. *Branchlets* 2—3 times furcate. *Oospores* (290—)330—350 μ long.

INDIA: Bengal, without exact locality and date, com. 1869, KURZ 1930 (B).

JAVA: Priangan, Geger Bentang, at the base of G. Gedeh, 1350 m alt., VII 1855, HASSKARL s.n. (B), *type*, in (Bz) is probably a duplicate from the type, as it has a note by HASSKARL: "*Nitella javanica* HSSKL an *Ch. polyclados* DON.?"

Remarks. In his type description BRAUN states that the branchlets are only twice furcate. This is not quite correct as there are also thrice furcate ones. BRAUN gives 120—140 μ as the size for the diam. of the antheridia, but these were probably not fully ripe, ripe antheridia having a diam. of c. 260 μ.

The f. *javanica* is distinguished from f. *indica* in having smaller oogonia and fewer furcate branchlets, and from f. *genuina* only in having larger oogonia, reason why this form most probably is to be regarded a synonym. The size of the oospores varies from 290—350 μ.

Distribution. Between 25° N. and 13° S.; ASIA, India: Bengal; Malaysia: Java. Moreover in lit.: Ceylon, BRAUN & NORDSTEDT (1882, p. 69).

f. 2. **indica** A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 13, 69; T. F. ALLEN, Charac. America 1, 1888, p. 47 (*nom. tant.*); NORDSTEDT in Hedwigia 27, 1888, p. 183; GUTWINSKI & NORDSTEDT in Bull. Int. Ac. Sci. Cracovie, Cl. Math. Nat., 1902, p. 578 — ? *Nitella oligospira* A. BR. f. *australiana* NORDSTEDT in Act. Univ. Lund. 25, 1889, p. 26; GROVES & ALLEN in Proc. Roy. Soc. Queensl., 46, 1935, pp. 40, 47 — *N. oligospira* A. BR. var. *australiensis* BAILEY, Compreh. Catal. Queensl. Pl., 1909, p. 678.

Illustrations. BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pl. 5, figs. 135—136.

Plants moderately stout. Diam. of the *stem* up to 880 μ. *Branchlets* 3—5 times furcate. *Oospores* 360—400 μ long.

INDIA: India Deserta, Lahore, no date, com. 1869, KURZ 2721 (B).

MALAY PENINSULA: Pegu, Kya Eng, 28 XII 1870, KURZ 3294 (B), *type*.

NICOBAR ISLANDS: Island of Kamorta, in a little river in a grassy plain, II 1875, KURZ 3918 (B), oospores immature.

JAVA: Batavia, in the river Tjiliwoeng (on the label is written: "Tjaljum"), 29 VIII and 7 IX 1877, DE LA SAVINIERRE 674 (K), a sterile, robust specimen, badly preserved; Kediri, Madjapahit, (on the label "Modjopait"), without date, TEIJSMANN s.n. (B, Bu-Mus, K).

NEW GUINEA: Papua, Kanosira, holes in a small stream in savannah woods, c. 150 m alt., 23 II 1935, CARR 11488 (B, L), sterile specimens.

Remarks. The plant of Madjapahit has the branchlets thrice furcate, and the ripe oospores are 360—390 μ long. NORDSTEDT gives in his key their length in the form *indica* as 390—400 μ. Therefore the plant of TEYSMANN is a transition towards the smaller *javanica*. In most of the other specimens the oospores are, if any, immature, but on account of their habit and the number of furcations they are inserted here. The CARR specimen from New Guinea has a remarkably bright green colour and is much fixed to the sheet.

Most probably NORDSTEDT's form *australiana* and BAILEY's var. *australiensis* (the same plant, but it is cited as a variety and the name is differently written) belong to this form. Though the plant has immature oospores, it has the usual number of furcations.

Distribution. Between 30° N. and 28° S.; ASIA, India; Nicobar Islands; Malaysia: Malay Peninsula, Java, New Guinea. Moreover in lit.: India: Bengal, GROVES (1924, p. 368); AUSTRALIA, Queensland, NORDSTEDT (1889, p. 26), BAILEY (1909, p. 678), GROVES & ALLEN (1935, p. 47).

20. Nitella burmanica PAL in Journ. Linn. Soc., Bot., 49, 1932, pp. 65, 77, pl. 12.

Plant monoecious, up to 30 cm high. *Internodes* 2—4 times the length of the branchlets. *Sterile branchlets* large, 6—7 in a whorl, 2—3 times furcate; secondary rays 3—4. *Fertile branchlets* short, 5—6 in a whorl, 4 times furcate; secondary rays 6. *Dactyls* 2—3, two-celled. ♂ and ♀ *gametangia* together at all branchlet-nodes and at the base of the whorls, aggregated, not enveloped in mucus. *Antheridia* 350 μ in diam. *Oospores* golden-brown, 300 μ long, with 6 ridges. *Membrane* not described.

Remarks. Closely allied to the other brachydactylous species, but characterized by the clustered oogonia and the fertile base of the whorls of branchlets. No specimens examined.

Ecology. In road-side ponds; ripe oospores were found not earlier than November.

Distribution. 16°30′ N.; ASIA, India: Burma.

21. Nitella tumulosa ZANEV., nov. spec.

Planta monoica, gracilis, cinereo-viridis, ad 25 cm alta. *Caulis* tenuis, usque ad 1000 μ diam. Internodia $^1/_3$—3-plo longitudine ramulorum. *Verticillorum ramuli* steriles fertilibus ± similes, normaliter 6, 3—4-plo furcati; radii primarii elongati, tertia parte longitudinis totius rami longi; radii secundarii normaliter 5—6; radii tertiarii 3—5; radii quaternarii 2—4; radii quintarii 3—1. *Dactyli* 3—1, bicellulati, cellula inferiore allantoidis, quam cellula superior leviter curvata conica permulto longior. *Antheridia* sessilia, terminalia, 230—355 μ diam. *Oogonia*

ad omnes nodos liberos posita, aggregata, 330—540 μ longa (coronula inclusa), 230—400 μ lata, striis 6—8, latissimis; *coronula* 40—89 μ alta, basi 50—102 μ lata; *oosporae* luteo-brunneae, 245—400 μ longae, 225—320 μ latae, striis 5—6; oosporae *membrana* tuberculata.

Plant monoecious, slender, of medium stature, up to 25 cm high, greyish green. *Stem* moderately stout, up to 1000 μ in diam. *Internodes* in the lower parts $^1/_3$—1, in the upper parts 1—3 times the length of the branchlets. *Sterile* and *fertile* branchlets ± similar, 6 in a whorl, 1—2 cm long, 3—4 times furcate; primary rays $^1/_3$ as long as the entire branchlet; secondary rays usually 5—6; tertiary rays 3—5; frequently all furcate into 2—4 quaternary rays; penultimate rays normally longer than the secondary and tertiary ones and frequently all forked into 3—1 quinary rays; all rays with exception of the ultimate one elongate, long and narrow. *Dactyls* 3—1, two-celled, some elongate, some very short, curved, inferior cell up to 1300 μ long and c. 120 μ wide, cylindrical and tapering at the apex, which has the same width as the base of the ultimate cell; ultimate cell conical, curved, 55—400 μ long, 12—57 μ wide at base. ♂ and ♀ *gametangia* produced at all free nodes, but rarely at the uppermost one and never at the base of the whorls, not enveloped in mucus. *Antheridia* solitary, strictly terminal, but sometimes seemingly lateral, 230—355 μ in diam., earlier ripe than the oogonia. *Oogonia* 1—6 together, irregularly ripening, 330—540 μ long (incl. coronula), 230—400 μ wide, *spiral-cells* showing 6—8 convolutions; *coronula* persistent, 40—89 μ high, 50—102 μ wide at base, individual cells of both rows small and of the same size, connivent, *oospores* bright-brown, 245—400 μ long, 225—320 μ wide with 5—6 ridges; *outer membrane* tuberculate.

R e m a r k s. The present new species has much resemblance with *Nitella orientalis* from Japan and Australia, but is different by the tuberculate oospore membrane (giving the impression of tumuli), and the occurrence of gametangia at the first branchlet-node. It has also much likeness with *N. microcarpa*, which is at once distinguished by the reticulate Nordstedt-markings and, moreover, by its 2—3-celled dactyls.

N. orientalis and *N. tumulosa* are akin in the variable length of the inferior cell of the dactyls; therefore both species are links between the macro- and the brachydactylous species of the *Bicellulatae*.

The plants belonging to this species are collected at two different localities and are different in the size of the gametangia. I have therefore distinguished the varieties *typica* and *pumila*.

Ecology. The plants are heavily covered with clay and diatoms.

Distribution. Between 4° N. and c. 28° S.; ASIA, Malaysia: Sumatra, Java.

var. α **typica** ZANEV., nov. var.

Illustrations. The pres. paper, figs. 5*a*, *c*.

Planta robustior. *Antheridia* c. 300—355 μ diam., terminalia, saepe simulate lateralia. *Oogonia* 425—540 μ longa (coronula inclusa); 340—400 μ lata; striis 7—8; *coronula* 68—89 μ alta, basi 78—102 μ lata; *oosporae* 340—405 μ longae, 280—320 μ latae, striis 6.

JAVA: without exact locality, date, and collector's name (probably KORTHALS), ex herb. BLUME ? (L), in Herb. Lugd. Bat. under no 936, 254 . . . 256, *type*.

Remarks. A peculiarity of this variety is the seemingly lateral insertion of the antheridia, as they move over to one side, however, they are terminally produced. The internodes are $^1/_3$—$1^1/_2$ times the length of the branchlets.

Distribution. Between c. 6° N. and c. 28° S.; ASIA, Malaysia: Java.

var. β **pumila** ZANEV., nov. var.

Illustrations. The pres. paper, fig. 5*b*.

Planta mediocriter robusta. *Antheridia* 230—265 μ diam., terminalia. *Oogonia* 330—365 μ longa (coronula inclusa), 230—260 μ lata; striis 6—7; *coronula* 40—60 μ alta, basi 50—72 μ lata; *oosporae* 245—285 μ longae, 225—255 μ latae, striis 5—6.

SUMATRA: Riouw & Depend., Natoena Islands, Island of Boengoeran, E. slope of G. Ranai, 250 m alt., in a stream, 10 IV 1928, VAN STEENIS 1157 (Bz), *type*.

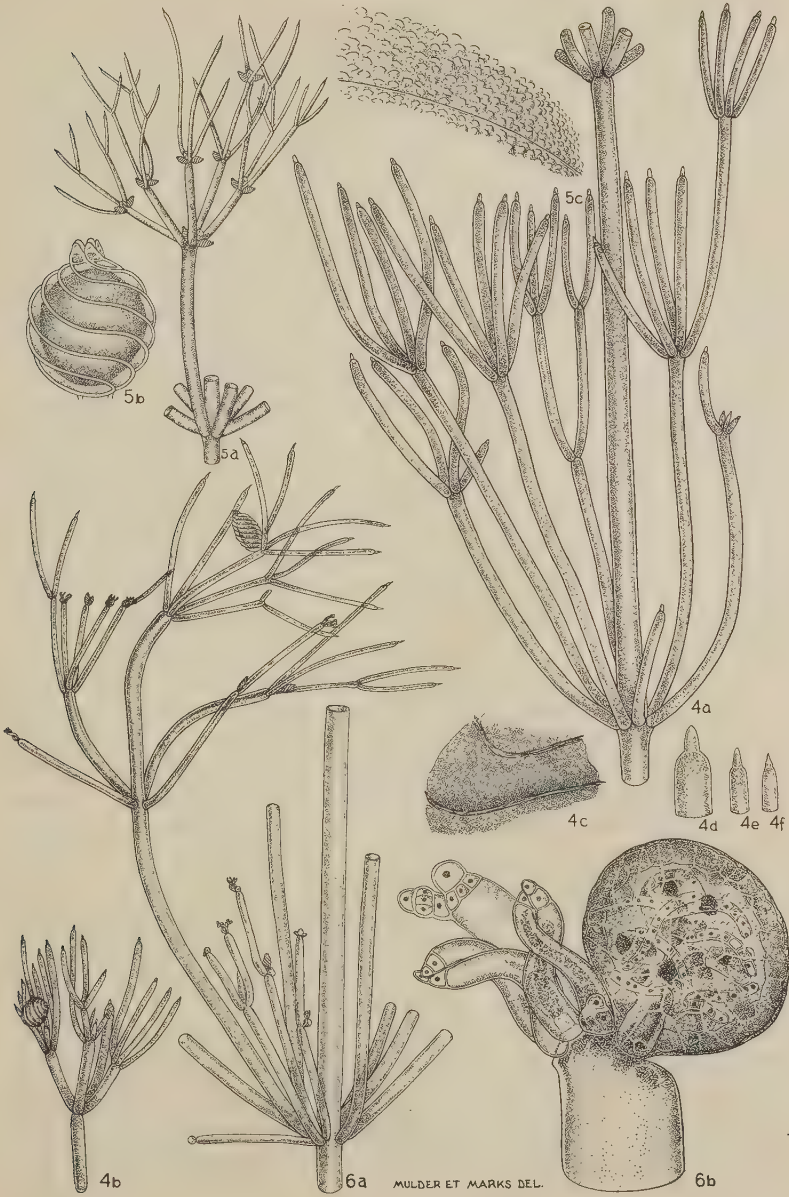
Remarks. The internodes of this var. are frequently 1—3 times as long as the entire branchlets, and therefore much longer than in var. *typica*.

Ecology. Very frequent in a swift flowing stream.

Distribution. On 4° N.; ASIA, Malaysia: Boengoeran.

22. Nitella furcata (ROXBURGH apud BRUZELIUS) AGARDH, Syst. Alg., 1824, p. 124; GRIFFITH, Not. Plant. Asiat. 2, 1849, p. 280; KUETZING,

Fig. 4, *Nitella sumatrana*; *a*. whorl of sterile branchlets, × c. 7; *b*. fertile branchlet, × c. 50; *c*. decoration of oospore membrane, × c. 165; *d*—*f*. apices of the two-celled dactyls (sterile whorls), × c. 4 — Fig. 5, *Nitella tumulosa*, n. sp.; *a*. (var. *typica*) stem-node with fertile branchlet, × c. 6; *b*. (var. *pumila*) mature oogonium, × c. 75; *c*. (var. *typica*) decoration of oospore membrane, × c. 225 — Fig. 6, *Nitella mucronata* var. *pseudogracilifrmis*; *a*. stem-node with fertile branchlet, × c. 8; *b*. apex of a ray with an antheridium, an immature oogonium (note the 4 spiral-cells) and a young branchlet, × c. 125.


5a
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Spec. Alg., 1849, p. 513; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 362, 368; id. in Journ. Bot. 65, 1927, p. 338; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 58; J. GROVES in Journ. Linn. Soc., Bot., 48, 1928, p. 132; PAL in Journ. Burma Res. Soc. 18, 1929, p. 113 (*nom. tant.*); id. in Journ. Linn. Soc., Bot., 49, pp. 65, 78; MUKERJI in Proc. 21st Ind. Sci. Congr., Bombay, 1934, p. 295; GROVES & ALLEN in Proc. Roy. Soc. Queensl., 46, 1935, pp. 41, 48; ALLEN & HERTER in Rev. Sudamer. Bot. 1, 1934, p. 88 (?); DIXIT in Journ. Ind. Bot. Soc. 14, 1935, p. 257; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, pp. 3, 9; ZANEVELD in Blumea 3, 1939, pp. 379, 382 — *Chara furcata* ROXBURGH apud BRUZELIUS (non *Chara furcata* HORNEMANN), Observ. gen. Chara, 1824; BRUZELIUS & FUERNROHR in Flora 9, 1826, p. 491; ROXBURGH, Flor. Indica 3, 1832, p. 564; ZOLLINGER, Syst. Verz. Ind. Arch. Ges. Pfl., 1, 1854, p. 4; BRAUN in Monatsb. Kön. Akad. Wiss. Berlin f. 1867, p. 816, note 1, 1868 (*nom. tant.*); ROXBURGH, Flor. Indica, 1874, p. 648; DE WILDEMAN, Prodr. Fl. Alg. Ind. Néerl., Suppl. et Tabl. Stat., 1899, p. 13 — *Nitella polyglochin* f. *japonica*, f. *javanica*, var. *nicobarica*, var. *Roxburghii*, var. *Zollingeri*, var. *Zollingeri* f. *nicobarica*; *Nitella Roxburghii*; *Chara Roxburghii*; cf. varieties.

Illustrations. G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, pl. 4 and text-f. 7; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, pl. 3, figs. 19—22.

Plant monoecious, dark to greyish green, up to 20 cm high. *Stem* slender to stout, 400—1100 μ in diam. *Internodes* 0.5—2 times the length of the branchlets. *Sterile branchlets* 6 in a whorl, spreading, 2—3.5 cm long, 2—4 times furcate; primary rays usually half as long as the entire branchlet; secondary rays (3—)4(—6), of which 1—2 are again forked into 2—3 tertiary rays; some of them again furcate into 2—3 quaternary rays; quinary rays, if any, 1—3. *Fertile branchlets* 6 in a whorl, 1—2.5 cm long, much more compact than the sterile ones, 2—3 times furcate; primary rays ½—¼ the length of the entire branchlet; secondary rays 3—6, of which 1—3 are again forked into 2—3 tertiary rays; some of them again furcate into 1—3 quaternary rays. *Dactyls* (1—)2(—3), two-celled, divergent, inferior cell up to 225 μ long, and 75 μ wide at base, though always abbreviated, somewhat varying in length, sometimes somewhat globular, tapering to the distal end, which has the same breadth as the base of the ultimate cell; ultimate cell conical, 75 μ long, 15—45 μ wide at base. ♂ and ♀ *gametangia* at all and the same free nodes, except the ultimate one, sessile, not surrounded by a mucous cloud. *Antheridia*

solitary, terminal, earlier ripe than the oogonia, 220—280 μ in diam. *Oogonia* 2—4 together, 240—450 μ long (incl. coronula), 220—320 μ wide, *spiral-cells* showing 8—9 convolutions; *coronula* 60—105 μ high, c. 90 μ wide at base, individual cells of the upper row much longer than those of the lower row, acuminate; *oospores* golden-brown, 190—300 μ long, 180—270 μ wide, with 6 broad ridges; *outer membrane* reticulate.

Vernacular name: Janj, (Bengal), which is, according to ROXBURGH (1832, p. 564), the general name for all such aquatic plants.

Remarks. The plants belonging to this species exhibit much variation in their habit, and in the size of the oospores, though the variation of the latter is less pronounced than in *N. microcarpa.* This is considered sufficient ground for the distinction of three varieties, i. e. *Roxburghii, Zollingeri,* and *nicobarica.* However, most authors did not state to which variety their plants belong; therefore I have cited that part of the literature at the head of the species.

The characteristic feature of *N. furcata* is the elongate upper row of coronula-cells, often more than twice the length of the lower row. These cells are in old plants spreading, but in young plants connivent. By this character it is distinguished from the other brachydactylous species, *N. mauritiana, N. guineensis* and *N. japonica* excepted, which are, moreover, different, the former two by their solitary oogonia, and the latter by its tuberculate oospore membrane. As I have not seen a specimen of MIGULA's *N. polyglochin* f. *japonica* (1930, p. 213) I cannot conclude as to an identity with *N. japonica* as was suggested by FILARSZKY (1934, p. 712); the size of the oospores differs considerably: those of *N. japonica* are 340 μ long, and those of *N. polyglochin* f. *japonica* only 250 μ.

Some confusion has been introduced into the nomenclature by BRAUN's attempt to establish the appropriate name of *N. polyglochin* for the collective species *furcata* (1882, p. 73), including the varieties *Roxburghii* and *Zollingeri,* and the form *nicobarica,* which is cited in NORDSTEDT's key as a variety. The name *polyglochin,* however, was already used for all *Brachydactylae* (1882, p. 13; NORDSTEDT, 1889, p. 7).

N. Roxburghii, published in 1849, seems to be identic (cf. GROVES, 1924, p. 368) with BRUZELIUS's *Chara furcata* published in 1824 and was already transferred in the same year to the genus *Nitella* by AGARDH. Therefore the name *furcata* is valid for the collective species..

With regard to the name *Chara furcata* HORNEMANN, to be found on several herbarium labels, it must be remarked that this is a synonym

to *C. corallina*. BRAUN published in 1835 a species under the name of *Chara Roxburghii*; as I did not see specimens, I cannot decide with certainty from the description alone what species is meant here.

Ecology. *N. furcata* is especially common in streams, rivers little ponds, rice-fields and moats. It is most probably very susceptible to the environmental conditions, as the habit of the plant is extremely variable.

According to GROVES (1927, p. 338) and G. O. ALLEN (1928, p. 59) this species occurs in India plentifully during the rains from September to January. From July to September, and, moreover, in February and March (cf. var. *Roxburghii*) plants with ripe oospores were collected in the Netherlands Indies.

To the Java specimens of var. *Zollingeri* collected by the German Limnol. Sunda Exped. the following notes are added: temperature 25°—33° C; pH 6.5; conductivity $0.23 \cdot 10^{-4}$. The Java specimen belonging to the same variety from herb. VAN DEN BOSCH, was collected together with *N. acuminata*.

Distribution. Between 30° N. and 36° S.; ASIA, India: Coromandelia; Pegu; Nicobar Islands; Malaysia: Malay Peninsula, Java, Borneo, Celebes; Soembawa; Philippine Islands; cf. varieties. Moreover in lit.: India: Malabaria, Kashmir, MUKERJI (1934, p. 295); Salsette, DIXIT (1935, p. 257); Ceylon, cf. var. *Roxb.*; Bengal, ROXBURGH (1832, p. 564); AGHARKAR & KUNDU (1937, p. 9); Gangetic Plain, Saharanpore, GROVES (1927, p. 338), ALLEN (1928, p. 58); Serampore, GRIFFITH (1849, p. 281); Burma, PAL (1932, p. 78); Malay Peninsula, GROVES (1924, p. 367) — AMERICA, ? N. Am., ex GROVES & ALLEN (1937, p. 48); S. Am., Uruguay, ALLEN & HERTER (1934, p. 88) — AFRICA, S. Afr.: Rhodesia, Uganda in herb. (K), according to a letter of Mr G. O. ALLEN; Madagascar, GROVES (1928, p. 133) — AUSTRALIA, Queensland, GROVES & ALLEN (1937, p. 48).

var. α **Roxburghii** (A. BRAUN) ZANEV., nov. comb. — *Nitella Roxburghii* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 293 (non *Chara Roxburghii* A. BR., 1835); id. in Monatsb. Kön. Akad. Wiss. Berlin f. 1867, p. 816, note 1, 1868 (*nom. tant.*); H. & J. GROVES in Philipp. Journ. Sci. 7, 1912, p. 69; J. GROVES in Journ. Linn. Soc., Bot., 46, 1922, p. 101 — *Nitella polyglochin* A. BR. var. *Roxburghii* A. BR. in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 13, 73; T. F. ALLEN, Charac. America 1, 1888, p. 47 (*nom. tant.*) — *Nitella polyglochin* A. BR. f. ? ap. BAILEY, Compreh. Catal. Queensl. Pl., 1909, p. 678; NORDSTEDT in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 3 (*nom.*

tant.) — ? *Nitella polyglochin* A. BR. f. *japonica* MIGULA in Hedwigia 70, 1930, p. 213.

Illustrations. BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pl. 5, figs. 140—144.

Plant stout, up to 30 cm high. *Stem* up to 1100 μ in diam. *Sterile branchlets* 1—2 times furcate, spreading. *Fertile branchlets* thrice furcate, compact. *Oospores* 270—310 μ long.

INDIA: Coromandelia, Madras, no date, WIGHT s.n., herb. HOOKER in (B), fragments of the *type*; Pegu, Kya Eng, 28 XII 1870, KURZ 3295 (B).

MALAY PENINSULA: Kedah, Pulo-Langkawi, in stream, 27 VIII 1925, HOLTTUM, St. of Kedah 17345 (Si).

PHILIPPINE ISLANDS: Luzon, Prov. of Ilocos Norte, Bangui, II—III 1917, RAMOS, Fl. of Philipp. 27465 (K).

Remarks. The Madras specimens of Dr WIGHT, which I saw from the Berlin herbarium, were most probably only fragments of the type of *N. Roxburghii*. This species was described in 1849 by BRAUN, as being of "considerable size", whereas the plants seen by me were only small fragments and unnumbered.

Distribution. Between 20° N. and 5° N.; ASIA, India: Coromandelia; Pegu; Malay Peninsula; Philippine Islands. Moreover in lit.: Ceylon, GROVES (1922, p. 101).

var. β **Zollingeri** (A. BRAUN) ZANEV., nov. comb. — *Nitella polyglochin* A. BR. var. *Zollingeri* A. BRAUN in G. VON MARTENS, Die Preuss. Exp. n. O.-As., Bot. Th., 1866, p. 143 (*nom. tant.*); BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 13, 74; T. F. ALLEN, Charac. America 1, 1888, p. 47 (*nom. tant.*); NORDSTEDT in Act. Univ. Lund. 25, 1889, p. 27 (?); DE WILDEMAN, Prodr. Fl. Alg. Ind. Néerl., 1897, p. 31; id., Suppl. et Tabl. Stat., 1899, p. 89; id., Alg. Fl. Buitenz., 1900, p. 376 — *Nitella polyglochin* A. BR. f. *javanica* FILARSZKY in Arch. Hydrobiol. 1934, Suppl. Bd. 12, Trop. Binnengew. Bd. 4, p. 711.

Illustrations. BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pl. 5, figs. 145–146; DE WILDEMAN, Alg. Fl. Buitenz., 1900, f. 141; FILARSZKY in Arch. Hydrobiol. 1934, Suppl. Bd. 12, Trop. Binnengew. Bd. 4, figs. 17—26.

Plant rather stout, up to 20 cm high. *Stem* 400—850 μ in diam. *Sterile* and *fertile branchlets* 3—4 times furcate, more or less similar. *Oospores* 225—265 μ long.

JAVA: Batavia, Batavia, III, no year, no collector's name, ex herb. VAN DEN BOSCH in (B, L); Buitenzorg, Buitenzorg, little pond at right border of river Tjiliwoeng, 20 IX 1928, German Limnol, Sunda Exped. B2d γ (Bu-Mus), *type* of *N. polyglochin* f. *javanica* FILARSZKY.

BORNEO: W. Division, Bengkajang[1]), in rice-fields and in moats, 22 III 1863, VON MARTENS 4 (B).

CELEBES: Celebes & Depend., near Makassar, in the river near Maros, 1 VII 1861, Prussian Exped. to East Asia, WICHURA 2072 (B).

SOEMBAWA: Najadea, in the river Oetan, VIII 1847, ZOLLINGER 3386 (B, *type* of *N. polyglochin* A. BR. var. *Zollingeri* A. BR.; L).

Remarks. The type of this variety collected in Soembawa was mentioned in BRAUN & NORDSTEDT (1882, p. 74) as sterile; closer examination, however, proved it to be fertile though immature. The same is the matter with the Java specimen in herb. VAN DEN BOSCH, which has ripe oospores too. BRAUN's figures 145 and 146 of the dactyls with the globular inferior cells are drawn after these plants. This character is not found in the other plants, and it is therefore not to be used for the variety.

Distribution. Between 1° N. and 20° S.; ASIA, Malaysia: Java, Borneo, Celebes, Soembawa. Moreover in lit.: AUSTRALIA, Queensland, NORDSTEDT (1889, p. 27, ?).

var. γ **nicobarica** (A. BRAUN) ZANEV., nov. comb. — *Nitella polyglochin* A. BR. var. *nicobarica* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 13; T. F. ALLEN, Charac. America 1, 1888, p. 47 — *Nitella polyglochin* A. BR. var. *Zollingeri* A. BR. f. *nicobarica* A. BR. in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 75; NORDSTEDT in Act. Univ. Lund. 25, 1889, p. 12.

Plant slender, up to 15 cm high. *Stem* 500—600 μ in diam. *Sterile branchlets* twice furcate, spreading. *Fertile branchlets* thrice furcate, compact. *Oospores* 180—220 μ long.

NICOBAR ISLANDS: without exact locality and date, ex herb. Hort. Bot. Hafn. 1854, DIDRICHSEN, Galathea exped. 2732 (B).

Remarks. The smallest of the three varieties. The branchlet-whorls are less compact and the internodes very long, up to 4 cm.

Distribution. 7° N.; ASIA, Nicobar Islands.

2. Series HETEROCELLULATAE ZANEV., nov. ser.

Articulationes ramulorum ultimae (dactyli) bi — tri-cellulatae.

Dactyls (ultimate rays of the branchlets) indifferently 2—3-celled.

Remarks. It seems desirable to unite the plants, which are intermediate between the *Bicellulatae* and *Pluricellulatae*, into a separate series: *Heterocellulatae*, just as the transitional plants between the subsections of the *Anarthrodactylae* and *Arthrodactylae* are placed in the subsection *Heterodactylae*.

[1]) Published in the "Fragmente" (1882, p. 74) as "Barkajang".

23. Nitella superba PAL in Journ. Linn. Soc., Bot., 49, 1932, pp. 64, 67, pl. 8; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 362, 369 (as *Nitella* sp. *N. myriotricha* KUETZ. prox.); KUNDU in Journ. Ind. Bot. Soc. 16, 1937, p. 267.

Plant dioecious, stout. *Internodes* of the male plant 1—3 times, of the female plant 2—5 times the length of the branchlets. *Sterile* and *fertile branchlets* ± similar, 5—6 in a whorl, in the male plant 2—4 times, in the female plant 3 times furcate; secondary rays 6. *Dactyls* 3—4, two- and three-celled. Fertile whorls forming heads enveloped in dense mucus. *Antheridia* solitary, at the first and second branchlet-nodes, 450 μ in diam. *Oogonia* solitary, at the lower three branchlet-nodes, 300—350 μ long (incl. coronula), showing 8—9 convolutions of the spiral-cells; *oospores* not described.

Remarks. Closely allied to *Nitella myriotricha*, differing only in the size of the oogonia. The female plant is much more infested with mucus than the male plant. No specimens examined.

Ecology. Unknown.

DISTRIBUTION. Between 26° N. and c. 12° N.; ASIA, India: Malabaria, Assam, Burma.

24. Nitella mucronata [1]) (A. BRAUN) MIQUEL in VAN HALL, Flor. Belg. septentr. 2, 1840, p. 428; KUETZING, Phyc. Germ., 1845, p. 256; id., Spec. Alg., 1849, p. 514; id., Tab. Phyc. 7, 1857, p. 13; BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10, 1849, p. 9; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 22; BRAUN in Monatsb. Kön. Akad. Wiss. Berlin f. 1867, p. 810, 1868; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 11, 50; T. F. ALLEN, Charac. Americ. 1, 1888, p. 45 (*nom. tant.*); NORDSTEDT in Act. Univ. Lund. 25, 1889, p. 9; T. F. ALLEN in Torrey Bot. Cl. 21, 1894, p. 524; id., Charac. America 2, 3, 1896, pp. 19, 20; GROVES & BULLOCK WEBSTER, Brit. Charoph. 1, 1920, pp. 92, 113; J. GROVES in Journ. Linn. Soc., Bot., 46, 1922, p. 98; id. in Journ. Linn. Soc., Bot., 46, 1924, pp. 361, 366; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 597; id. in Journ. Ind. Bot. Soc. 7, 1928, p. 56; J. GROVES in Journ. Linn. Soc., Bot., 48, 1928, p. 127 (var. *mobilis*); PAL in Journ. Burma Res. Soc. 18, 1929, p. 113 (*nom. tant.*); MIGULA in Hedwigia 70, 1930, p. 212; PAL in Journ. Linn. Soc., Bot., 49, 1932, pp. 64, 71; STROEDE, Oekol. d. Charac., 1931, p. 26; MUKERJI in Proc. 21st Ind. Sci. Congr., Bombay, 1934, p. 295; ALLEN & HERTER in Rev. Sudameric. 1, Bot. 1, 1934, p. 88 (var. *leiopyrena*); DIXIT in Journ. Ind. Bot. Soc. 14, 1935, p. 257; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S., 1, 1937, pp. 3, 6; HASSLOW in Bot. Not., Lund, 1939, p. 295; ZANEVELD, in Blumea 3,

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[1]) The European literature is to be found in MIGULA (1897, p. 149) and in GROVES & BULLOCK WEBSTER (1920, pp. 113—114).

1939, pp. 379, 382 (var. *mobilis*) — *Chara mucronata* A. BRAUN in Ann. Sci. Nat., Bot., 2, 1834, p. 35; id. in Flora 18, 1835, p. 52 — *Nitella flabellata* KUETZING, Phyc. Gen., 1843, p. 318; id., Phyc. Germ. 1845, p. 256 (var. *tenuior*) — *Nitella exilis* A. BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10, 1849, p. 9; KUETZING, Spec. Alg., 1849, p. 515; id., Tab. Phyc. 7, 1857, p. 13 — *Nitella pseudograciliformis*, cf. variety.

Illustrations. KUETZING, Tab. Phyc. 7, 1857, pl. 33; NORDSTEDT in Act. Univ. Lund. 25, 1889, f. 18; T. F. ALLEN, Charac. America 2, 3, 1896, unnumbered pl.; MIGULA, Die Charac., 1897, figs. 42—44; id., Syn. Charac. europ., 1898, figs. 30—32; GROVES & BULLOCK WEBSTER, Brit. Charoph. 1, 1920, pl. 1 & 12; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, f. 5; GROVES in Journ. Linn. Soc., Bot., 1928, pl. 5, figs. 7—8, pl. 7, f. 5; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, pl. 3, figs. 6—14.

Plant monoecious, dark to brownish green, up to 30 cm high, more or less covered with clay. *Stem* moderately stout, 430—680 μ in diam. *Internodes* 1—2 times the length of the branchlets. *Sterile branchlets* more or less similar to the fertile ones, but the latter more compact; both 5—6 in a whorl, 2—3 times furcate (the fertile branchlets usually only 3 times); primary rays up to $^2/_3$ as long as the entire branchlet; secondary rays 4—5 (—6); tertiary rays 2—4 (—5); quaternary rays (dactyls) 2—3 (—4). *Dactyls* 2—3, usually two-celled, rarely three-celled, inferior cell rounded at the apex, ultimate cell much narrower, conical, acute, forming a mucro. ♂ and ♀ *gametangia* at all free nodes, not surrounded by a mucus cloud. *Antheridia* solitary, 240—310 μ in diam. *Oogonia* solitary or seldom geminate, 430—625 μ long (incl. coronula), 320—400 μ wide; *spiral-cells* showing 7—9 convolutions; *coronula* 32—55 μ high, c. 80 μ wide at base, persistent, interstices below the coronula for the admission of the spermatozoids distinctly visible; *oospores* dark-brown to almost black, 256—350 μ long, 234—300 μ wide, with 6—7 thin ridges; *outer membrane* translucent, reticulate.

JAVA: C. Priangan, Tjihandjawar near Poerwakarta, in rice-fields, 650 m alt., 22 VII 1920, BAKHUIZEN VAN DEN BRINK 4279* (Bz).

Remarks. The specimen cited above is very poor and badly preserved and therefore I can only refer it to this species in a broader sense. *N. mucronata* is a very variable species and the number of varieties and subspecies distinguished is high, most probably on account of the fact that the habit of this plastic species is to a high degree susceptible to environmental conditions. A review of the variability is

very well given by MIGULA (1897), who states that the only varieties worth while to be distinguished are BRAUN's ssp. *Wahlbergiana* from Scandinavia and *virgata* from Europe, Asia, N. Africa and N. America. These are characterized, the first by the short secondary rays and the much contracted fertile whorls, and the latter by the frequently three-celled dactyls, the geminate oogonia, and the yellow-brown oospore membrane.

Afterwards GROVES & BULLOCK WEBSTER (1924, p. 117) distinguished a variety *gracillima* from Great Britain especially on account of the penultimate dactylous cell tapering gradually to the apex, so that the apex is not much broader than the base of the apical cell. In 1928 (p. 127) GROVES again described a new var. *mobilis,* collected in Madagascar and characterized by the wide variation in the length and shape of the ultimate cell of the dactyl. It is, however, questionable whether these last two varieties have reasonable ground for existence.

Nitella mucronata is very much relied to *N. pseudoflabellata,* which has more rays at the second and ultimate furcations and the primary ray always longer than half the length of the entire branchlet. The new variety forms a transition between these two species.

E c o l o g y. *Nitella mucronata* is a dark-green coloured plant of medium size, usually much infested with epiphytes and clay and sometimes incrusted with lime. It occurs in shallow water of ponds and rice-fields, in India in the earlier part of the cold season, i. e. from October to April. The bottom of the ponds in which it grows consists of soft mud, containing sometimes 40.4 % organic substances (STROEDE, 1931, p. 26).

It is found growing together with *Nitella acuminata, N. flexilis, Chara fibrosa* ssp. *gymnopitys, C. globularis,* and the Phanerogams: *Potamogeton crispus, Najas minor,* and *Hydrilla verticillata.*

D i s t r i b u t i o n: Between 42° N. and 35° S.; ASIA, M a l a y s i a: Java, Bali, cf. variety. Moreover in lit.: EUROPE, cf. MIGULA (1897, p. 158) and GROVES & BULLOCK WEBSTER (1920, p. 116) — ASIA, S o n g a r i a, RUPRECHT (1845, p. 10), BRAUN & NORDSTEDT (1882, p. 52); J a p a n, T. F. ALLEN (1894, p. 524), MIGULA (1930, p. 212); I n d i a: W. Himalaya, MUKERJI (1934, p. 295); Malabaria, GROVES (1924, p. 266), Pashan, DIXIT (1935, p. 257); Ceylon, GROVES (1922, p. 98); Gangetic Plain, Saharanpur, ALLEN (1928, p. 56), Gonda, GROVES (1924, p. 366), ALLEN (1925, p. 597), Benares, GROVES (1924, p. 366), Sonarpur, AGHARKAR & KUNDU (1937, p. 6); Burma, GROVES (1924, p. 366), PAL (1934, p. 71) — AMERICA, N. A m.: New Hampshire, Masachusetts,

Virginia, BRAUN & NORDSTEDT (1882, pp. 51, 52, 53); N. Carolina, T. F. ALLEN (1896, p. 21); Texas; C. Am.: Mexico, BRAUN & NORDSTEDT (1882, pp. 53, 54); S. Am.: Uruguay, ALLEN & HERTER (1934, p. 88) — AFRICA, N. Afr.: Algeria, BRAUN (1868, p. 812); Egypt, Abyssinia, BRAUN & NORDSTEDT (1882, p. 52); S. Afr.: Cape Colony, BRAUN (1868, p. 812); Madagascar, GROVES (1928, p. 127).

var. α **pseudograciliformis** (FILARSZKY) ZANEV., nov. comb. — *Nitella pseudograciliformis* FILARSZKY in Arch. Hydrobiol. 1934, Suppl. Bd. 12, Trop. Binnengew., Bd. 4, p. 707; id. in Math. u. Naturw. Anz. Ung. Akad. Wiss. 52, 1935, p. 468 (*nom. tant.*); J. GROVES in Journ. Bot. 73, 1935, p. 48 (*nom. tant.*).

Illustrations. FILARSZKY, *l. c.* 1934, figs. 3—9; the pres. paper, figs. 6*a*—*b*.

Plants slender, flexible, elongate. *Stem* c. 500 μ in diam. *Internodes* 2—3 times the length of the entire branchlets. *Sterile branchlets* 6 in a whorl, c. 2 cm long, 2—3 times furcate; *fertile branchlets* 6—7 in a whorl, c. 1.5 cm long, more compact, 3 times furcate; in both kinds of branchlets 5—6 secondary rays, 2—5 tertiary rays, 2—4 quaternary rays. *Dactyls* 2—4, usually two-celled, occasionally three-celled; inferior cell in the sterile branchlets up to 2 mm long and c. 60 μ wide, in the fertile branchlets up to 1.5 mm long and c. 50 μ wide; ultimate cell of both 60—90 μ long, c. 45 μ wide at base. *Antheridia* terminal, c. 290 μ in diam. *Oogonia* lateral, in a very young state always two together, when older solitary; mature oogonia (only 3 extant) 623 μ long (coronula incl.), 400 μ wide; *spiral-cells* showing 8—9 convolutions; *coronula* 53 μ high, c. 80 μ wide at base; interstices distinctly visible; *oospore* very dark-brown to purplish black, 312 μ long, 267 μ wide, with 6—7 ridges.

BALI: Danaubrätan, little caldera lake near Batoeriti, alt. 1231 m, German Limnol. Sunda Exped. BB2a (Bu-Mus), *type* of *N. pseudograciliformis* F.

Remarks. In the base of the sterile and fertile whorls of the specimens cited, frequently one or two short, and once or twice furcate fertile branchlets occur. This is often the case in this species, cf. GROVES & BULLOCK WEBSTER, pl. 1 and 12 (1920). However, the type specimen shows in only one whorl between two normal branchlets, 4 of these short, once-furcate fertile branchlets, originating from the same nodal cell; 3 of these bear at the first furcation one antheridium (terminal), one oogonium (lateral), and one ray; at the ultimate node of this secondary ray again one terminal antheridium, but two lateral oogonia are found. The primary ray of the fourth branchlet

is furcate into 3 secondary rays, each bearing at the ultimate node one antheridium and two oogonia (cf. f. 6*a*).

The occurrence of these short branchlets at this node was most probably the reason, why FILASZKY described the plants as belonging to the "*Heterophyllae*" (= *Heteroclemae*). It is obvious, that this is not the case, and that these branchlets belong to an accessory shoot of which the internodal cell is not developed. FILARSZKY's figures 3 and 5 are imperfect. The whole plant is somewhat aberrant, as antheridia and oogonia are to be found at every place where a branchlet is dropped. Moreover, the oogonia often have but four spiral-cells, cf. f. 6*b*.

I have given an emendation of the description of FILARSZKY showing that his species is identic with *N. mucronata*, although having some characters of *N. pseudoflabellata*. It differs from the latter in having geminate oogonia, and from the normal forms of the former in the somewhat higher number of rays at the various furcations of the branchlets, and is therefore separated as a variety thereof.

E c o l o g y. On the label of the badly preserved specimens the following notes are added: temperature of the surface 22°.1 C., pH 6.8, alkalinity 0.16; diam. of the caldera lake c. 2.6 km, total depth 22 m. It was found growing at a depth of 10 m together with *Chara fulgens*.

D i s t r i b u t i o n. On 8°30′ S.; ASIA, M a l a y s i a: Bali.

25. Nitella tenuissima (DESVAUX) KUETZING var. α **byssoides** A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 64; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 362, 367 — *Nitella byssoides* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 294; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 23.

Plant monoecious, extremely minute. *Internodes* 2—5 times the length of the branchlets. *Sterile* and *fertile* branchlets similar, 6 in a whorl, twice furcate; secondary rays 6—7. *Dactyls* 3—4, invariably two- and three-celled. ♂ and ♀ *gametangia* together at the second and third branchlet-nodes, lacking at the first node and at the base of the whorls, solitary, not enveloped in mucus. *Antheridia* c. 175 μ in diam. *Oospores* yellowish brown, 190 μ long, with 6—7 ridges. *Membrane* with beaded reticulation.

R e m a r k s. The species has much resemblance ~~with~~ to *Nitella mucronata*, *N. gracilis* and *N. batrachosperma*, but is at once distinguished by the sterile first branchlet-node. The variety is only once collected on the coast of Coromandel and this is, moreover, the only record of the species from Asia. Otherwise the species is very common in Europe, and is also known from N. America, the West Indies and from N. and S. Africa, Madagascar incl.. No Malaysian specimens examined.

E c o l o g y. In Great Britain the species is restricted to fenlands only.

D i s t r i b u t i o n. On c. 15° N.; ASIA, I n d i a: Coromandelia.

26. **Nitella elegans** PAL in Journ. Linn. Soc., Bot., 49, 1932, pp. 64, 75, pl. 11.

Plant monoecious, extremely slender, up to 15 cm high. *Internodes* 2—4 times the length of the branchlets. *Sterile branchlets* lax, 8 in a whorl, 3—4 times furcate; secondary rays 8. *Fertile branchlets* similar, but smaller and enveloped in mucus. *Dactyls* 3, two- and sometimes three-celled. ♂ and ♀ *gametangia* together at the second and third branchlet-nodes, and occasionally at the first and uppermost ones, solitary. *Antheridia* 175—210 μ in diam. *Oospores* reddish to dark-brown, 220 μ long, with 7—8 ridges. *Membrane* not described.

Remarks. The most striking peculiarity of this species is the production of a fertile branchlet in the axils of the first furcation of the branchlets of the upper whorls. No specimens examined.

Ecology. In a pond at short distances from each other, apparently preferring solitary to gregarious growth, though there was plenty of room and little competition offered by other plants.

Distribution: 22° N.; ASIA, India: Burma.

27. **Nitella polycarpa** PAL in Journ. Linn. Soc., Bot., 49, 1932, pp. 65, 77, pl. 13.

Plant monoecious, fairly tall. *Internodes* 2—3 times the length of the branchlets. *Sterile* and *fertile branchlets* similar, 6 in a whorl, 3—5 times furcate, secondary rays 2—4. *Dactyls* 2—3, two-, occasionally three-celled. ♂ and ♀ *gametangia* together at all branchlet-nodes, oogonia also at the base of the whorls, aggregated, not enveloped in mucus. *Antheridia* 275 μ in diam. *Oospores* light-brown, 260 μ long, with 6—7 ridges. *Membrane* finely nodose-reticulate.

Remarks. Readily distinguished from the nearly allied *Nitella microcarpa* and *N. furcata* by the occasional presence of a three-celled dactyl, and by the whorls being sterile. No specimens examined.

Ecology. In shallow water together with a large number of other plants, such as *Marsilia, Azolla,* and *Cyanophyceae*.

Distribution. 18° N.; ASIA, India: Burma.

28. **Nitella microcarpa** A. BRAUN in Monatsber. Kön. Akad. Wiss. Berlin, 1858, p. 357; NORDSTEDT in Hedwigia 27, 1888, p. 183; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 13, 71; T. F. ALLEN, Charac. America 1, 1888, p. 47 (*nom. tant.*); NORDSTEDT in Acta Univ. Lund. 25, 1889, p. 11; H. & J. GROVES in URBAN, Symb. Antill. 7, 1911, pp. 30, 36; NORDSTEDT in Proc. Roy. Soc. Victoria, N. S. 31, 1918, p. 3 (*nom. tant.*); RIDLEY in Journ. Straits Branch R. A. Soc. 80, 1919, p. 163; J. GROVES in Journ. Linn. Soc., Bot., 46, 1922, p. 101; id. in Journ. Linn. Soc., Bot., 46, 1924, pp. 362, 368; MUKERJI in Proc. 21st Ind. Sci. Congr., Bombay, 1934, p. 295; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, pp. 41, 47 — *Nitella Glaziovii*; *Nitella microcarpa* f. *santosa*, f. *santosa-tenuior*, ssp. *Glaziovii*; *Nitella microglochin*; *Nitella polyglochin*; *Chara timorensis*; cf. varieties.

Illustrations. BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pl. 2, figs. 56—57; pl. 3, fig. 78.

Plant monoecious, dark-brownish green, up to 25 cm high. *Stem* moderately slender to stout, 500—1100 μ in diam. *Upper internodes* half to as long as the length of the branchlets; *lower internodes* usually somewhat longer. *Sterile branchlets* 6 in a whorl, up to 4 cm long, 2—3 times furcate, much spreading; primary rays half as long as the entire branchlet, sometimes longer; secondary rays 4—6; tertiary rays 2—4, of which usually 1—3 are again furcate into 1—3 quaternary rays. *Fertile branchlets* 6 in a whorl, 1.5—2 cm long, 3—4 times furcate, much condensed; primary rays $^1/_3$—$^1/_2$ the length of the entire branchlet; secondary rays 4—6; tertiary rays 3—5, of which 1—2 are again forked into 2—3 quaternary rays; quinary rays, if any, 1—3. *Dactyls* 1—3, usually two-celled, but often three-celled dactyls are also extant especially in the sterile branchlets; inferior cell varying in length, up to 1000 μ long and 55—120 μ wide, ultimate cell conical, 60—150 μ long, 20—90 μ wide at base. ♂ and ♀ *gametangia* frequently at all and the same nodes, however, when the dactyls are very short, the ultimate node usually sterile (cf. var. *microglochin*), the base of the branchlet-whorls always so, not enveloped in mucus. *Antheridia* sessile, solitary, terminal, 180—290 μ (—400 μ, var. *megacarpa*) in diam. *Oogonia* sessile, lateral, frequently 2—4 (sometimes more) together around one antheridium; 250—530 μ long (incl. coronula), 210—415 μ wide; *spiral-cells* showing 7—8 convolutions; *coronula* 30—80 μ high, 45—100 μ wide at base, persistent, both rows of cells equal in length; *oospores* golden-brown, 180—450 μ long, 225—450 μ wide, with 6 sharp ridges; *outer membrane* reticulate.

Remarks. Owing to the extremely variable length of the dactyls, the brachydactylous group has a large number of species, which are very closely allied to each other. A ready means of identifying *Nitella microcarpa* is provided by the short coronula, the clustered oogonia (lacking at the base of the whorls), and the variable length of the dactyls. By these characters it is distinguished from *N. oligospira, N. furcata,* and *N. polycarpa,* whereas *N. burmanica* has strictly two-celled dactyls. *N. orientalis,* finally, has the oospore membrane granulate, whereas it is reticulate in the other brachydactylous species.

The sizes of the oospores and the variable length of the dactyls are features, important enough for some authors to base new species upon, viz. *N. microglochin, Glaziovii,* and *megacarpa*. In this connection I have to state that I could study the type of *N. microglochin* extant in the Berlin herbarium. Obviously the type has

aggregate oogonia and not solitary ones, as was accepted formerly. The dactyls are for the greater part all very short, since the inferior cell of the dactyls is sub-quadratic. Therefore, I consider it a variety of *N. microcarpa.*

In the type of *N. microcarpa* collected in Paramaribo (Netherlands Guyana) and extant in (B), there are but very few abbreviated dactyls as is clearly visible in BRAUN's fig. 78 on pl. 3 (1882), and, moreover, many of the dactyls are three-celled. In my opinion, these plants and the other ones mentioned by BRAUN (1858, p. 357) must be included in his var. *Drummondii* described in 1882 (p. 72); the length of the ripe oospores vary from 180—240 μ.

In the "Fragmente" two other subspecies of *N. microcarpa* are distinguished, viz. *Glaziovii* with oospores of 240—280 μ length, and *megacarpa* in which they are 370—450 μ. Afterwards two more new varieties were distinguished, viz. *natalensis* by SYDOW from Natal (MIGULA, SYDOW and WAHLSTEDT, Charac. exsicc.), and var. *Wrightii* by H. & J. GROVES (1911, p. 37) from Cuba (W. Indies), which most probably have to be combined with one of the four varieties cited above; without having seen the types I have to refrain from a decision.

The plants from the Indian and Malaysian areas known at present, appear to belong to the varieties *microglochin* and *Glaziovii* only, and to a new var. *papuana.*

E c o l o g y. Cf. the varieties.

D i s t r i b u t i o n. Between 45° N. and 35° S.; ASIA, I n d i a: Pegu; M a l a y s i a: Malay Peninsula, Perak, Penang; Sumatra, Java, Borneo, Celebes, Timor, New Guinea, cf. varieties. Moreover in lit.: ? C h i n a, ? J a p a n, ex GROVES & ALLEN (1937, p. 48); I n d i a: W. Himalaya, MUKERJI (1934, p. 295); Bengal, AGHARKAR & KUNDU (1937, p. 8); Burma, PAL (1932, p. 76); Ceylon, GROVES (1922, p. 101) — AMERICA, N. A m.: Canada, Louisiana, BRAUN & NORDSTEDT (1882, p. 71, 72, var. *Drummondii*); Michigan, Massachusetts, T. F. ALLEN (in Charac. exsicc.); C. A m.: Cuba, NORDSTEDT (1888, p. 183); GROVES (1911, p. 36, p. 37, var. *Wrightii*), Abarca, Jamaica, Guadeloupe, GROVES (1911, p. 36); Panama, BRAUN (1858, p. 367); S. A m.: Netherlands Guyana, BRAUN (1858, p. 367), Brazil, cf. var. *Glaziovii* — AFRICA, S. A f r.: Cape Colony, cf. var. *Glaziovii*; Natal, in herb. (L); ?? Madagascar [1]), ex GROVES (1924, p. 368) — AUSTRALIA, Q u e e n s l a n d, GROVES & ALLEN (1937, p. 47).

[1]) This locality is not to be found elsewhere in the literature, and as it is not cited in GROVES' article on the Madagascar *Charophyta* (1928) either, it is dubious.

var. α **microglochin** (A. BRAUN) ZANEV., nov. comb. — *Nitella microglochin* A. BRAUN in ZELLER, Journ. Asiat. Soc. Bengal 42, 1873, p. 193 (*nom. tant.*); BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 13, 71; T. F. ALLEN, Charac. America 1, 1888, p. 47 (*nom. tant.*); NORDSTEDT in Act. Univers. Lund. 25, 1889, p. 11; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 362, 368; PAL in Journ. Burma Res. Soc. 18, 1929, p. 113 (*nom. tant.*); id., in Journ. Linn. Soc., Bot., 49, 1932, pp. 65, 75 — *Chara timorensis* ZIPPELIUS in Herb. Lugd. Bat. — *Nitella polygochin* A. BR. sens. lat. ap. NORDSTEDT in Forsch. Reise S. M. S. "Gazelle", 4 Th. Bot., 1889, p. 7.

Plant rather slender. *Stem* up to 600 μ in diam. *Dactyls* frequently all extremely short, usually two-celled, only occasionally three-celled; inferior cell nearly as long as broad, 35—110 μ long, 40—85 μ wide, ultimate cell conical, slightly curved, 60—70 μ long, 20—40 μ at base. ♂ and ♀ *gametangia* frequently lacking at the ultimate branchlet-node. *Oogonium* c. 310 μ long (incl. coronula), 290 μ wide; *oospore* 180—240 μ long, 225—260 μ wide.

INDIA: Pegu, Arakan (formerly published as "Arracan"), Kolodyne Valley, in a jungle swamp, X 1869, KURZ s.n. (B), *type* of *N. microglochin* A. BR.

MALAY PENINSULA: Perak, Gunong Tungal, Dindings, in muddy water on a path in jungle, III 1896, RIDLEY, St. of Perak 7142, (K, Si); ibid., Dindings, II 1897, RIDLEY, St. of Perak s.n., (Si); ibid., Sungei Siput, in a stream, 11 IX 1920, BURKILL, St. of Perak 6331 (Si); Penang, without exact locality, waterface in pond, VII 1889, CURTIS, Fl. of Penang 1887 (Si).

CELEBES: Pangkadjene, no date, TEYSMANN 11930 (Bz).

TIMOR: without exact locality, no date[1]), ZIPPELIUS s.n. ~~(Bz)~~; S. Timor, Koepang, 15 V 1875, NAUMANN 337 and 338 (B); ibid., Pariti, 22 V 1875, NAUMANN 6 (B); both specimens immature, therefore identification uncertain.

Remarks. This variety was formerly distinguished as a species from *N. microcarpa* on account of the "solitary" oogonia. Re-examination of the type, however, showed that the oogonia were clustered and situated around one antheridium.

The size of the oospores and the sub-quadratic inferior cells of the dactyls may serve to discriminate this variety from var. *Glaziovii* and *papuana*.

Ecology. In jungle swamps and in ponds. It seems that a muddy bottom is preferred, as the plants are densely covered with clay. Specimens with ripe oospores as far as known from our area have been collected in July, October and February. According to PAL (1932, p. 86), the seasonal distribution in Burma is restricted to

[1]) ZIPPELIUS collected here in 1828.

October and November. The plants are overgrown with epiphytes.

RIDLEY (1919, p. 163) remarks to his plants from the Gunong Tungal, Dindings, that he found the footprint of a rhinoceros in the middle of the jungle, where water had gathered, quite full of specimens of a *Nitella* species, the oospores having probably been transported in mud by the rhinoceros from some distance. This illustrates very well the capricious dispersion of *Charophyta.*

Distribution. Between 20° N. and 10° S.; ASIA, India: Pegu; Malaysia: Malay Peninsula, Celebes, Timor. Moreover in lit.: Burma, PAL (1932, p. 76).

var. β **Glaziovii** (ZELLER) ZANEV., nov. comb. — *Nitella Glaziovii* ZELLER ap. WARMING in Vidensk. Meddel. naturh. For. Kjoebenh., 1876, p. 428; NORDSTEDT in Act. Univ. Lund. 25, 1889, p. 11; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, pp. 3, 8 — *Nitella microcarpa* A. BR. ssp. *Glaziovii* (ZELLER) NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 72; T. F. ALLEN, Charac. America 1, 1888, p. 47 (*nom. tant.*); NORDSTEDT in Act. Univ. Lund. 25, 1889, p. 27 — *Nitella microcarpa* A. BR. ssp. *Glaziovii* (ZELLER) NORDSTEDT f. *santosa* NORDSTEDT and f. *santosa-tenuior* NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 73.

Illustrations. NORDSTEDT in Act. Univ. Lund., 1889, f. 27; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, pl. 4, figs. 1—9.

Plant stout. *Stem* up to 1100 μ in diam. *Dactyls* varying much in length, frequently one or two much longer than the other one(s); sometimes all much elongate or abbreviated, two- and occasionally three-celled; inferior cell up to 1000 μ long, and 120 μ wide, ultimate cell conical, up to 150 μ long, and 90 μ wide. ♂ and ♀ *gametangia* only extant at the ultimate branchlet-node, if one or more of the dactyls are elongated. *Oogonia* 415—475 μ long (incl. coronula), 300—325 μ wide; *oospores* 240—280 μ long, 220—250 μ wide.

MALAY PENINSULA: Perak, Bruas, Dindings, III 1896, RIDLEY, St. of Perak 7144 (K, Si).

SUMATRA: Benkoelen, Enggano, Boca-boea, c. 100 m alt., in the river, 30 V 1936, LÜTJEHARMS 3935 and 4343 (L).

JAVA: Malang, Roemah klampok, 300 m alt., 14 V 1936, J. H. ? 74 (Bz).

BORNEO: without exact locality, no date[1]), MOTLEY 728 (K).

Remarks. Variety *Glaziovii* is much more robust than var. *microglochin*, and is otherwise distinguished in having one or more elongate dactyls; it has larger oogonia than this var. and var. *papuana.*

Ecology. In a river; covered with clay and overgrown with

[1]) MOTLEY collected here between 1854 and 1859.

epiphytes. In one case together with *N. acuminata.* Malaysian plants with ripe oospores have been collected in March and May.

Distribution. Between 5° N. and 35° S.; ASIA, Malaysia: Malay Peninsula, Sumatra, Java, Borneo. Moreover in lit.: Bengal, AGHARKAR & KUNDU (1937, p. 8) — AMERICA, S. Am.: Brazil, ZELLER (1876, p. 428), NORDSTEDT (1889, p. 11), BRAUN & NORDSTEDT (1882, p. 73) — AFRICA, S. Afr.: Cape Colony, NORDSTEDT (1889, p. 27).

var. γ **papuana** ZANEV., nov. var.

Planta tenuis, elongata. *Caulis* 500—600 μ diam. *Dactyli* saepe inaequales, interdum omnes abbreviati vel unus duobus aliis multo longior, 2- (vel interdum 3-) cellulati; cellula inferior ad 1000 μ longa, 70—100 μ lata; cellula ultima conica, ad 90 μ longa, basi c. 45 μ lata. ♂ et ♀ *gametangia* ad nodos 3 primarios, verticilli basi nulla. *Oogonia* 480—570 μ longa (coronula inclusa), 340—370 μ lata; *oosporae* 300—350 μ longae, 260—320 μ latae.

NEW GUINEA: Papua, Rouna, in a pool on an enormous rock in Laloki river, c. 60 m alt., 29 V 1935, CARR 12425 (B and L, *type*).

Remarks. The plants of this new variety are extremely flexible, and fixed to the paper and to each other. This variety comes very near to var. *Glaziovii,* but differs in having larger oogonia.

Ecology. In a pool on a rock.

Distribution. 3° S.; ASIA, Malaysia: New Guinea.

3. Series PLURICELLULATAE J. GROVES in Journ. Bot. 73, 1935, p. 49; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1925, p. 41; ZANEVELD in Blumea 3, 1939, p. 380 — *Nitellae flabellatae* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 198, *pro parte* — Subsect. *Polyarthrae* A. BRAUN ap. VON LEONHARDI in Lotos 13, 1863, repr. p. 11; id. in Verh. naturf. Ver. Brünn 2, 1864, repr. p. 39; BRAUN, Consp. syst. Charac. europ., 1867, p. 2 — Sect. *Polyarthrodactylae* A. BRAUN in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 797, 1868; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 14; T. F. ALLEN, Charac. America 1, 1888, p. 48; MIGULA, Die Charac., 1897, p. 98; NORDSTEDT in Proc. Roy. Soc. Vict., N.S. 31, 1918, p. 3; KUNDU in Journ. Ind. Bot. Soc. 16, 1937, p. 266 — Subsect. *Arthrodactyles* HY in Bull. Soc. bot. France 60, 1913, Mém. 26, p. 16, *pro parte.*

Dactyls (ultimate rays of the branchlets) indifferently 2—6-celled.

29. **Nitella Alleninda** ZANEV., nov. spec.

Illustrations. The pres. paper, figs. 3*a*—*h*.

Planta monoica, minima, gracillima, ad 3—5 cm alta, pallide brunnea. *Caulis* tenuis, 250 μ diam. *Internodia* ramulis breviora vel aequalia. *Verticillorum ramuli steriles* normaliter 6, aequales, c. 1.5 cm longi, simplices bis furcati; radii primarii $^1/_2$—$^1/_3$ totius longitudinis ramulorum; radii secundarii 4—5, eorum 1—2 in radios 2—4 tertiarios furcati. *Verticillorum ramuli fertiles* 6—7, longitudine sterilium aequales, plerumque 3-plo interdum 4-plo furcati, radii primarii $^2/_3$ totius longitudinis ramulorum; radii secundarii 5—6; radii tertiarii 4—5 eorum 1—3 in radios quaternarios 2—4 furcati; omnes radii gradatim breviores, ultimis longissimis exceptis. *Dactyli* steriles 2—4, (2—)4(—5)-cellulati mucrone 65—130 μ longa, basi 25—45 μ lata; dactyli fertiles 2—4, 3(—5)-cellulati, mucrone 30—90 μ longa, basi 15—25 μ lata; omnes cellulae gradatim breviores; cellula superior conica, cellula penultima apice rotundata. ♂ et ♀ *gametangia* sessilia, conjuncta, in omnibus nodis liberis, nodo primo excepto. *Antheridia* solitaria, terminalia, c. 205 μ diam. *Oogonia* solitaria, lateralia, 361—395 μ longa (coronula incl.), 260—271 μ lata, striis 7—8; *coronula* 45—56 μ alta, basi 51—62 μ lata; *oosporae* 237—249 μ longae, 187—205 μ latae, striis 6; *membrana* oosporae tuberculata.

Plant monoecious, very small and graceful, only 3—5 cm high, pale-brown, not incrusted at all. *Stem* very slender, up to 250 μ in diam. *Internodes* as long as or somewhat shorter than the branchlets. *Sterile branchlets* 6—7 in a whorl, the longest 1.5 cm, frequently once, seldom twice furcate; primary rays $^1/_2$—$^1/_3$ as long as the entire branchlet; secondary rays 4—5, of which 1 or 2 are sometimes again furcate into 2—4 tertiary rays; only the lowest 1—2 whorls being sterile. *Fertile branchlets* 6—7 in a whorl, c. 1.5 cm long, forming loose heads, thrice furcate; primary rays $^2/_3$ the length of the entire branchlet; secondary rays 5—6, much shorter than the primary ones, all divided into 4—5 tertiary rays, of which 1—3 are again forked into 2—4 quaternary rays; the ultimate rays are always much longer than the penultimate ones. *Dactyls* 2—4, 2—5-celled, in the sterile whorls usually 4-celled, ultimate cell 65—130 μ long, 25—45 μ wide at base; in the fertile whorls usually 3-celled, ultimate cell 30—90 μ long, 15—25 μ wide at base; successive cells in both kinds of dactyls gradually shorter, penultimate cell rounded at the apex, ultimate cell $^1/_3$ as broad as the penultimate one; dactyls all different in length. ♂ and ♀ *gametangia* sessile, together at the same and all free branchlet-nodes, except the lowest one and the base of the whorls, not enveloped in mucus. *Antheridia* solitary, terminal, c. 205 μ in diam., earlier ripe

than the oogonia. *Oogonia* solitary, lateral, 361—395 μ long (incl. coronula), 260—271 μ wide; *spiral-cells* showing 7—8 convolutions; *coronula* 45—56 μ high, 51—62 μ wide at base, persistent; *oospores* dark-brown to almost black, 237—249 μ long, 187—205 μ wide, with 6 ridges; *outer membrane* tuberculate.

JAVA: Priangan, near Tjiparoegpoeg, in a little pool in a valley of the G. Papandajan, c. 2500 m alt., 14 V 1931, VAN STEENIS 4799 (Bz), *type*.

Remarks. This graceful species is the only and first member of the *Polyarthrodactylae* collected in the Netherlands Indies. It has much resemblance with the only European species of this section, *N. ornithopoda*, also occurring in Africa, and with *N. havaiensis* from the Sandwich Islands. These are both robust plants, and have the oogonia and antheridia clustered, whereas they are solitary in the present species. For *N. ornithopoda* the aggregated oogonia are not mentioned, but I have studied the plants from the Gironde, collected by MOTELAY (cf. "Fragmente", 1882, p. 90), which show this feature. This species differs moreover in having less furcate fertile branchlets, a lower number of rays at the different nodes, smaller antheridia, and larger oogonia. Moreover, in *N. havaiensis* the first branchlet-node is fertile.

A third allied species is *N. bonaerensis* from S. America, which I have not seen. This is a more robust plant, with more furcate branchlets, whereas the penultimate cell is frequently as narrow as the ultimate one. ALLEN & HERTER write (1934, p. 90), that a plant collected in Uruguay differs from the type in being sterile at the first forking.

The specific name commemorates Mr G. O. ALLEN, the indefatigable collector of and publicist on Indian *Charophyta*.

Ecology. "A very delicate species with orange organs" and "very frequent in a pool of 20 cm^2 with a depth of 3—4 cm", are annotations given on the herbarium-label.

Distribution. 7° S.; ASIA, Malaysia: Java.

II. Sectio HETEROCLEMAE J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 360; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 51; PAL in Journ. Linn. Soc., Bot., 49, 1932, p. 64; J. GROVES in Journ. Bot. 73, 1935, p. 47; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 41; ZANEVELD in Blumea 3, 1939, p. 380 — Subsect. *Heterophyllae* A. BRAUN in Flora 22, 1839, p. 310; id. in HOOKER's Journ. Bot. 1, 1849, pp. 195, 197; VON LEONHARDI in Lotos 13, 1863, repr. p. 9; id.

in Verh. naturf. Ver. Brünn 2, 1864, repr. p. 39; A. BRAUN, Consp. syst. Charac. europ., 1867, p. 2; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 10, 13; T. F. ALLEN, Charac. America 1, 1888, pp. 43, 48; MIGULA, Die Charac., 1897, p. 98; H. & J. GROVES in URBAN, Symb. Antill. 7, 1911, p. 31; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 427; NORDSTEDT in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 3 — *Nitellae furcatae heterophyllae* A. BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10, 1849, p. 10 — Subsect. *Heteroclemae* GROVES & BULLOCK WEBSTER, Brit. Charoph. 1, 1920, p. 126.

Each whorl of branchlets consisting of two or more rows, viz. one primary row composed of elongate and compound branchlets, and one or more accessory rows above and below the primary one, formed by small and less furcate branchlets.

30. **Nitella hyalina** [1]) (DC.) AGARDH, Syst. Alg., 1824, p. 126, *pro parte*; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 14, 79 (var. *indica*); J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 362, 369; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 597; id. in Journ. Ind. Bot. Soc. 7, 1928, p. 59, pl. 5, f. 1; DIXIT in Journ. Ind. Bot. Soc. 10, 1931, p. 205; PAL in Journ. Linn. Soc., Bot., 49, 1932, pp. 64, 66; MUKERJI in Proc. 19th Ind. Sci. Congr., Bangalore, 1932, p. 328; G. O. ALLEN in Journ. Ind. Bot. Soc. 12, 1933, p. 17; MUKERJI in Proc. 21st Ind. Sci. Congr., Bombay, 1934, p. 295; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S., 1, 1937, pp. 3, 9, pl. 5, figs. 1, 2; STEWART in Journ. Mitchell Soc. 53, 1937, p. 173, text-f. 1 and pl. 16 — *Chara hyalina* DE CANDOLLE, Fl. Franç. 5, 1815, p. 247, *pro parte*.

Plant monoecious, medium-sized, up to 30 cm high. *Internodes* 2—4 times the length of the branchlets. *Branchlets* in three rows of 8 each, two rows of short accessory branchlets, one above and one below the longer middle primary branchlets. Primary branchlets 2—3 times furcate; secondary rays 7—10. *Dactyls* 4—5, uniformly two-celled. *Accessory branchlets* of the upper row once furcate into 5 rays; those of the lower row once or twice furcate into 4—6 rays. ♂ and ♀ *gametangia* together at all nodes of the primary branchlets and occasionally at those of the accessory branchlets, solitary, enveloped in mucus. *Antheridia* 350—425 μ in diam. *Oospores* reddish brown, 250—335 μ long, with 6—7 ridges. *Membrane* granulate.

Remarks. It is somewhat surprising that this species is not yet collected in Malaysia as it is very common both in India and in Australia. Identified at once by the presence of the accessory branchlets. No Malaysian specimens examined.

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[1]) The literature here mentioned concerns only the area under discussion; other articles, illustrations and synonyms (not seen by the author) are to be found in BRAUN & NORDSTEDT (1882, p. 7), MIGULA (1897, p. 190) and in GROVES & BULLOCK WEBSTER (1920, p. 127).

Ecology. In the shallower water of pools, etc. DIXIT (1931, p. 205) has found it in a saltwater mudflat near the sea shore.

Distribution. Between 70° N. and 40° S.; EUROPE — ASIA: Songaria; Persia; India; China; Japan — N. & S. AFRICA — N., C. & S. AMERICA — AUSTRALIA.

2. TOLYPELLA A. BR. emend. VON LEONH.

Genus TOLYPELLA VON LEONHARDI in Lotos 13, 1863, reprint p. 12; id. in Verh. naturf. Ver. Brünn, 2, 1864, repr. p. 39; A. BRAUN in COHN, Krypt. Fl. Schles. 1, 1876, pp. 368, 400; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 93; T. F. ALLEN, Charac. America 1, 1888, p. 51; id. in Bull. Torrey Bot. Cl. 10, 1883, p. 109; MIGULA, Die Charac., 1897, p. 198; NORDSTEDT in Proc. Roy. Soc. Vict., N. S. 31, 1918, p. 4; GROVES & BULLOCK WEBSTER, Brit. Charoph. 1, 1920, p. 129; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 360; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 592; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 426 — Sect. *Caudatae* A. BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10, 1849, p. 11 — Subgen. *Tolypella* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 199, *pro parte*; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 797, 1868; id., Consp. syst. Charac. Europ., 1867, p. 3 — Sect. *Pseudobracteatae* WALLMAN, Försök. syst. Charac., 1853, p. 39, *pro parte*; id. in Act. Soc. Linn. Bordeaux 21, 1856, p. 13.

Branches usually more than two at a stem-node. *Sterile branchlets* simple or furcate; *fertile branchlets* furcate with very unequal rays, normally forming dense heads. ♂ and ♀ *gametangia* frequently long-stalked. *Antheridia* solitary, lateral at the nodes of the branchlets and, at times, also at the base of the whorls, thus representing secondary rays. *Oogonia* always aggregated, originating from the basal node-cell of the antheridium, or from those of the primary rays, thus representing a branchlet of a higher order than the antheridium. *Oospores* subglobose, hence terete in transverse section.

Remarks. According to T. F. ALLEN (1882, p. 109) the genus is to be divided into two sections on account of the shape of the ultimate cell of the rays and the branchlets.

Distribution. About 14 species in fresh and brackish water in all parts of the world, especially in the northern hemisphere.

Key to the sections and species [1].

1a. Ultimate cell of the branchlets and rays conical (Conoideae) . . . . 1. *T. prolifera*
b. Ultimate cell of the branchlets and rays obtuse (Allantoideae) . . 2
2a. Antheridia 700—750 μ in diam. . . . . 2. *T. hispanica*
b. Antheridia 325—375 μ in diam. . . . . 3. *T. glomerata*

I. Sectio CONOIDEAE GROVES & BULLOCK WEBSTER, Brit. Charoph. 1, 1920, p. 130; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 362, 370 — Sect. *Acutifolia* T. F. ALLEN in Bull. Torrey Bot. Cl. 10, 1883, p. 110; id., Charac. America 1, 1888, p. 51.

[1]) Cf. note [1]) on p. 51.

Ultimate cell of the branchlets and rays conical, acute and short. Spiral-cells of oogonium not swollen at the apex. Coronula persistent.

1. **Tolypella prolifera**[1]) (WALLR.) VON LEONHARDI in Lotos 13, 1883, repr. p. 57; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 362, 370; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 597; id in Journ. Ind. Bot. Soc. 7, 1928, p. 60, pl. 5, text-f. 8; id. in Journ. Ind. Bot. Soc. 15, 1936, p. 51 — *Chara translucens* AG. var. *prolifera* WALLROTH in Fl. Crypt. Germ., 1833, p. 106.

Plant monoecious, very stout, up to 35 cm high. *Branchlets* 6—20 in a whorl, very unequal; *sterile branchlets* simple, much elongate, 3—5 celled; *fertile branchlets* in dense heads, once or twice furcate. *Rays* 2—3 at each node, simple or furcate. Dactyls 3—5-celled; ultimate cell conical. ♂ and ♀ *gametangia* at the branchlet-nodes and at the base of the whorls. *Antheridia* c. 300 μ in diam. *Oospores* dull-brown, 330—400 μ long, with 9 ridges. *Membrane* flat.

Remarks. Different from the related *Tolypella intricata* by the stout non-furcating sterile branchlets. No Malaysian specimens examined.

Ecology. In shallow water of ditches and in rivers with a low velocity. According to ALLEN (1928, p. 60) the species is very constant in the time of appearance: it commences in December and ripe oospores are still found in February.

Distribution. Between 50° N. and 40° S.; EUROPE — ASIA, INDIA: Gangetic Plain; China: Yunnan — N. and S. AMERICA.

II. Sectio ALLANTOIDEAE GROVES & BULLOCK WEBSTER, Brit. Charoph. 1, 1920, p. 135; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 362, 370 — Sect. *Obtusifolia* T. F. ALLEN in Bull. Torrey Bot. Cl. 10, 1883, p. 110; id., Charac. America 1, 1888, p. 51.

Ultimate cell of the branchlets and rays allantoid, rounded at the apex and not abbreviated. Spiral-cells of the oogonium not swollen at the apex at maturity. Coronula deciduous.

2. **Tolypella hispanica**[1]) NORDSTEDT in Act. Univ. Lund. 25, 1889, pp. 18, 14, f. 44; T. F. ALLEN, Charac. America 1, 1888, p. 51 (*nom. tant.*); OFFNER in Bull. Soc. bot. France 70, 1922, p. 77; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 362, 370.

Plant dioecious, moderately stout. The description is similar to that of the following species, *T. glomerata*, the gametangia excepted. *Antheridia* stalked, 700—750 μ in diam. *Oospores* brown, 225—300 μ long, with 7—8 ridges. *Membrane* finely granulate.

Remarks. This species, which has never been adequately described, is closely allied to *T. glomerata*. No specimens examined.

Ecology. In rivers.

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[1]) The literature here mentioned concerns only our area; further titles, synonyms (not checked by the author) and illustrations are to be found in BRAUN & NORDSTEDT (1882, p. 97), MIGULA (1897, p. 203), GROVES & BULLOCK WEBSTER (1920 p. 133).

D i s t r i b u t i o n. Between 45° N. and 25° N.; EUROPE — ASIA, P e r s i a; I n d i a: India Deserta — N. AFRICA.

3. **Tolypella glomerata** [1]) (DESV.) VON LEONHARDI in Lotos 13, 1863, repr. p. 57; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 362, 370 — *Chara glomerata* DESVAUX ap. LOISELEUR-DESLONGCHAMPS, Not. Pl. aj. Fl. France, 1880, p. 135.

Plant monoecious, moderately stout. *Branches* usually 2—6 at a stem-node. *Branchlets* 6—12 in a whorl; *sterile branchlets* simple, elongate, 3—5-celled; *fertile branchlets* in dense heads, once furcate. *Rays* 4—5, the central ray 3—4-celled, the lateral 3-celled. *Ultimate* cell obtuse. ♂ and ♀ *gametangia* at the nodes of the branchlets, and oogonia frequently at the base of the whorls. *Antheridia* 325—375 μ in diam. *Oospores* brown, 300—375 μ long, with 7—9 ridges. *Membrane* linear-granulate.

R e m a r k s. This species resembles very much *T. nidifica*, which differs in having much larger gametangia, claret oospores, and a smooth oospore-membrane.

E c o l o g y. In brackish and fresh water of pools and ditches.

D i s t r i b u t i o n. Between 60° N. and 45° S.; EUROPE — ASIA, I n d i a: W. Himalaya, India Deserta; C h i n a? — N. AMERICA — AFRICA.

II. CHAREAE VON LEONH.

Tribus CHAREAE VON LEONHARDI in Lotos 13, 1863, repr. p. 12; id. in Verh. naturf. Ver. Brünn 2, 1864, repr. p. 40; H. & J. GROVES in URBAN, Symb. Antill. 7, 1911, p. 31; HY in Bull. Soc. bot. France 60, 1913, Mém. 26, p. 5; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, p. 1; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 360; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 428; PAL in Journ. Linn. Soc., Bot., 1932, p. 64; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 40; ZANEVELD in Blumea 3, 1939, p. 378 — Gen. *Chara* AGARDH, Syst. Alg., 1826, p. XXVII; BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10, 1849, p. 12; id. in HOOKER's Journ. Bot. 1, 1849, p. 200; id., p. 294; id., Consp. syst. Charac. europ., 1867, p. 3; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 797, 1868 — *Charae pleurogynae* et *hypogynae* A. BRAUN in Ann. Sci. Nat. 1, sér. 2, 1834, p. 353; id. in Flora 18, 1835, pp. 12, 57, 58; id. in Linnaea 17, 1843, pp. 116, 117 — Fam. *Chareae* A. BRAUN in COHN, Krypt. Fl. Schles. 1, 1876, pp. 368, 402; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 16; T. F. ALLEN, Charac. America 1, 1888, p. 52 (*Charae*); G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 592 — Subfam. *Chareae* A. BRAUN ap. MIGULA, Die Charac., 1897, p. 252; ROBINSON in Bull. New York Bot. Gard. 4, 1906, p. 253.

Plants with (generally in corticated species) or without calcareous incrustation. Stem and branchlets with or without *cortical-cells*.

[1]) Cf. note on p. 110.

Branches, similar to the main stem, usually one at a stem-node in the axil of the oldest branchlet. *Branchlets* 6—12 in a whorl on each stem-node, not furcate, with one-celled bract-cells at the branchlet-nodes. *Stipulodes*, being one-celled organs, at the base of the branchlets, rudimentary or present in a single or double row. Cells of the *coronula* in a single row of five cells.

Key to the genera.

1a. Stipulodes rudimentary; bract-cells 1—3 at a node, very long; branchlets consisting of 2—5 very long articulations; ecorticate; dioecious, antheridia and oogonia lateral . . . . 3. **Nitellopsis**
b. Stipulodes present, sometimes rudimentary; bract-cells normally 4 or more, short; branchlets consisting of 4 or more articulations; corticate or ecorticate; dioecious or monoecious 2
2a. Antheridium situated above the oogonium (not yet collected in our area) . . . . 4. **Lamprothamnium**
b. Antheridium situated at either side of each oogonium . . 5. **Lychnothamnus**
c. Antheridium situated below the oogonium . . . . 6. **Chara**

Note. As I already pointed out in Blumea 3, 1939, p. 378, FILARSZKY's genus *Charina* (1937, p. 490) from Western Australia is too badly defined to give it a place in the *Charophyta* system. The description is only based on vegetative parts of a plant mounted on a microscopical slide and nothing can be said about the situation of the gametangia which procure at present important features for the classification of the genera. It is much to be hoped that the plant may be collected again.

3. NITELLOPSIS HY

Genus NITELLOPSIS HY in Bull. Soc. bot. France 36, 1889, p. 397; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, p. 2; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 360, 370; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 592; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 428; PAL in Journ. Linn. Soc., Bot., 49, 1932, p. 64 — *Nitella* sect. *Pseudobracteatae* WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 33, *pro parte* — *Chara* subgen. *Tolypellopsis* VON LEONHARDI in Lotos 13, 1863, repr. p. 13 — *Chara* sect. *Tolypellopsis* VON LEONHARDI in Verh. naturf. Ver. Brünn. 2, 1864, repr. p. 41 — *Chara* sect. *Astephanae* A. BRAUN, Consp. syst. Charac. europ., 1867, p. 3; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 798, 1868; id. in COHN, Krypt. Fl. Schles. 1, 1876, p. 402 — *Tolypellopsis* (VON LEONH.) MIGULA, Die Charac., 1890, p. 253.

Stem and branchlets entirely without *cortical-cells*. *Stipulodes* rudimentary. *Branchlets* with 2—5 articulations. *Bract-cells* 1—3 at

each branchlet-node, much elongated. *Bracteoles,* being one-celled organs originating from the node at the base of the oogonium, absent. ♂ and ♀ *gametangia* arising as direct outgrowths from the peripheral cells of the branchlet-nodes.

Remarks. The discovery of a plant in the island of Lombok by Dr HEBERER, described below as *Nitellopsis sarcularis,* leads to an emendation of the diagnosis of the genus. The emendation concerns the branchlets, which do not have 2—3 but 2—5 articulations, and the stipulodes being not absent, but rudimentary. For further particulars I refer to *N. sarcularis.*

Distribution. Three species in fresh water of Europe, India, Malaysia, and Australia.

Key to the species [1].

1a. Fertile branchlets with 2—3 free nodes. . . . . 1. *N. obtusa*
b. Fertile branchlets with 3—4 free nodes. . . . . . 2. **N. sarcularis**

1. Nitellopsis obtusa [2]) (DESVAUX) J. GROVES in Journ. Bot. 57, 1919, p. 127; id. in Journ. Bot. 60, 1922, p. 54; id. in Journ. Linn. Soc., Bot., 46, 1924, p. 370; PAL in Journ. Linn. Soc., Bot., 49, 1932, p. 79; MUKERJI in Proc. 19th Ind. Sci. Congr., Bangalore, 1932, p. 328; id. in Proc. 21st Ind. Sci. Congr., Bombay, 1934, p. 295 — *Chara obtusa* DESVAUX ap. LOISELEUR-DESLONGCHAMPS, Not. Pl. aj. Fl. France, 1810, p. 136 — *Chara stelligera* BAUER ap. REICHENBACH in MOESSLER, Gemeinn. Handb. Gewächsk. 3, ed. 2, 1829, p. 1595 — *Nitella stelligera* KUETZING, Sp. Alg., 1849, p. 518; id., Tab. Phyc. 7, 1857, pl. 27 — *Lychnothamnus stelliger* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 17, 102, pl. 6, f. 189 — *Nitellopsis stelliger* HY in Rev. Bot. 8, 1890, p. 46 — *Tolypellopsis stelligera* (BAUER) MIGULA, Die Charac., 1890, p. 255, figs. 70—73.

Plant dioecious, robust, c. 40 cm high. Lower stem-nodes white, star-shaped, with long rhizoid-like branches. *Internodes* as long as or somewhat longer than the branchlets. *Branchlets* 5—7 in a whorl, consisting of 2—3 articulations. *Bract-cells* 1—2, up to as long as the ultimate branchlet-articulation. ♂ and ♀ *gametangia* 1—2 together at the two lowest nodes. *Antheridia* 750—1000 μ in diam. *Oospores* golden-brown, c. 775 μ long, with 7 ridges terminating in short basal claws. *Membrane* minutely granulate.

Remarks. This species is at once distinguished by its habit and when lower stem-nodes are collected, by their star-shape. The distribution is remarkable for the disjunct area. Different from *N. sarcularis* by the lower number of fertile branchlet-articulations. No Malaysian specimens examined.

Ecology. MUKERJI (1932, p. 328) collected the species in Kashmir at

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[1]) Cf. note on p. 51.

[2]) European literature, other synonyms and illustrations are to be found in BRAUN & NORDSTEDT (1882, p. 102), MIGULA (1897, p. 255) and GROVES & BULLOCK WEBSTER (1924, p. 3).

a depth of about 25 feet together with *Nitella acuminata, N. flagelliformis* and *N. hyalina*. All these plants are able to withstand low intensities of light.

Distribution. Between 65° N. and 23° N.; EUROPE — ASIA, India, W. Himalaya, Burma.

2. Nitellopsis sarcularis ZANEV., nov. spec.

Illustrations. The pres. paper, figs. 8*a*—*e*.

Planta dioica, gracilis, elongata. Planta feminea ignota. *Caulis* tenuis, 340—400 μ diam. *Internodia* quam ramuli 1—1½-plo longiora. *Stipulodia* uniseriata; plerumque non inchoata, apiculata. *Verticillorum ramuli steriles* 5—7, incurvati, ecorticati, 3—4 articulationibus, ad 4 cm longa. *Verticillorum ramuli fertiles* 6, in capitula congesti, incurvati, ecorticati, 4—5 articulationibus. *Bracteae* 2 laterales antheridiis aequales, 1 anteriore ramulis fertilibus orta parce evoluta, sterilibus autem elongata, ad 6 mm longa. *Antheridia* 1—2 aggregata, plerumque 2, in omnibus nodis primo sterili excepto, c. 450 μ diam.

Plant dioecious, slender, yellowish green, incrusted; most probably rather long (some small fragments of male plant only were collected). *Stem* slender, 340—400 μ in diam. *Internodes* as long as, or slightly longer than the sterile branchlets. *Stipulodes* rudimentary, only one found developed, small and apiculate, c. 133 μ long, 80 μ wide. *Sterile branchlets* 5—7 in a whorl, very long, up to 4 cm, slightly incurved, containing 2—3 free nodes, the articulations gradually tapering into the apex, though the second articulation is usually the longest, ultimate articulation long acuminate, or short conical, thus forming a mucro. *Fertile branchlets* 6 in a whorl, up to 1 cm long, forming loose heads, containing 3—4 free nodes, articulations as in the sterile branchlets. *Bract-cells* 1—3, up to 6 mm long (but then always only 1) at the lower nodes of the sterile branchlets, at the upper node frequently reduced to papillae; those of the fertile branchlets up to 450 μ long, but more

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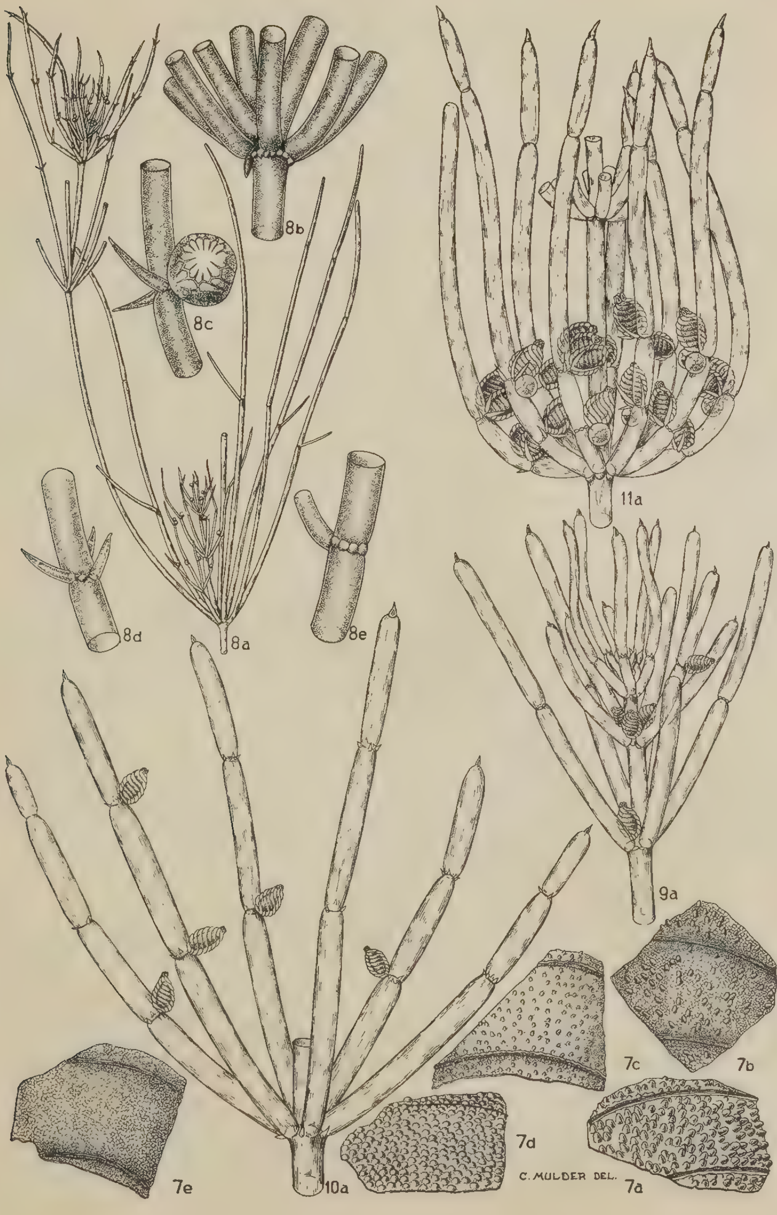
Fig. 7, *Nitella pseudoflabellata*, "NORDSTEDT-markings" of different oospore membranes; *a*. (var. *mucosa*) specimen collected by VAN STEENIS 4962b, × c. 275; *b*—*e*. var. *mutila*; *b*. and *c*. type specimen of Loemar, collected by E. VON MARTENS, × c. 275; *d*. specimen collected by ZIPPELIUS, × c. 275; *e*. specimen collected by JUNGHUHN (herb. VAN DEN BOSCH), × c. 275 — Fig. 8, *Nitellopsis sarcularis*, n. sp.; *a*. habit, × c. 2; *b*. stem-node with stipulodes, of which only one has developed, the others being rudimentary, × c. 12; *c*. branchlet-node with antheridium, × c. 22; *d*. branchlet-node with 2 two-celled bract-cells, × c. 23; *e*. branchlet-node, × c. 23 — Fig. 9, *Chara australis* var. *Vieillardii* f. *simplicissima*; *a*. part of female plant with whorls of fertile branchlets, × c. 5 — Fig. 10, *Chara fulgens*; *a*. stem-node with whorl of fertile branchlets, × c. 4 — Fig. 11, *Chara pashanii*; *a*. stem-node with whorl of fertile branchlet, × c. 4.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8c
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9a
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7d
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C. MULDER DEL.
7a

numerous, apiculate or acuminate, one-celled. *Antheridia* 1—2 together, frequently 2, at all free nodes, the ultimate one excepted and not at the base of the whorls, c. 450 μ in diam.

LOMBOK: Segara anak, alt. c. 2000 m, 1927, HEBERER s.n. (Bz), *type*.

Remarks. It is a pity that only very few fragments of a male plant of this interesting genus were collected in Malaysia, as these fragments show important differences with the only species of this genus known at present and occurring in Europe and India. These particulars are: 1°. The fertile branchlets have rarely 3 articulations but usually 4, whereas the number of articulations of the sterile branchlets is usually 3 and seldom 2 (GROVES & BULLOCK WEBSTER remark for the genus [1928, p. 28]: "There is usually only one and never more than two nodes"); 2°. The ultimate cell of the sterile branchlets is elongated and frequently longer than the bract-cell on the same branchlet; those of the fertile branchlets are, however, usually short and conical (GROVES & BULLOCK WEBSTER, *l. c.*, write: "The apical cell, instead of being short and conical, is elongated and cylindrical"); 3°. The stipulodes are usually rudimentary though in one case a developed one was extant (f. 8*b*). As far as I know this has never been observed in the genus and it shows moreover, that the lower peripheral cells of the stem-nodes are indeed rudimentary stipulodes. This is in contradiction to MIGULA (1890, p. 266), who states: "dasz dieser Gattung ein Stipularkranz vollständig fehlt"; 4°. The number of bract-cells for *N. obtusa* is mentioned by GROVES & BULLOCK WEBSTER (*l. c.*, p. 4) as 1—2 and by MIGULA (1897, p. 258) as 1—3. In the present species the number is 1—3; 5°. Antheridia are normally geminate and rarely solitary at the inner side of the branchlets, thus quite the reverse of *N. obtusa*, and they are seldom surrounded by 1 or 2 bract-cells. The antheridia are smaller than in *N. obtusa*, viz. up to 500 μ in diam.

As the lower parts of the plant were not collected, unfortunately nothing can be said about eventual star-like nodes as are occurring in *N. obtusa*.

The above cited characters were hitherto not yet observed for *N. obtusa*, though it is obvious that the new species must be included in this genus. The diagnosis thereof is emended in this sense. The name was given to the species on account of the resemblance of the branchlets with a weed-hook.

In one case two bract-cells were two-celled (cf. f. 8*d*); the same was observed by NORDSTEDT (1866, p. 113) in *N. obtusa*.

Ecology. Unknown.
Distribution. On 8°30′ S.; ASIA, Malaysia: Lombok.

5. LYCHNOTHAMNUS (RUPR.) VON LEONH.

Genus LYCHNOTHAMNUS (RUPR.) VON LEONHARDI in Lotos 13, 1863, repr. p. 12; id. in Verh. naturf. Ver. Brünn 2, 1864, repr. p. 40; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wish. Berlin, 1882, p. 102, *pro parte*; T. F. ALLEN, Charac. America 1, 1888, p. 52, *pro parte*; A. BRAUN in COHN, Krypt. Fl. Schles. 1, 1876, p. 401; MIGULA, Die Charac., 1897, p. 286; HY in Bull. Soc. bot. France 60, 1913, Mém. 26, p. 5; GROVES & BULLOCK WEBSTER, Brit. Charoph. 1, 1920, p. 91; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 361; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 592; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 428; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, p. 3 — Sect. *Charae pleurogynae* A. BRAUN in Ann. Sci. Nat. 1, sér. 2, 1834, p. 353; id. in Flora 18, 1835, pp. 12, 57 — Gen. *Charopsis* KUETZING, Phyc. Gen., 1834, p. 319, *pro parte*; id., Phyc. germ., 1845, p. 256, *pro parte* — Sect. *Lychnothamnus* RUPRECHT in Beitr. Pfl. Russ. Reiches 3, 1845, p. 11, *pro parte* — Sect. *Charae barbatae* A. BRAUN in N. Denkschr. Schw. Ges. Naturw. 10, 1849, p. 12, *pro parte* — *Chara* subgen. *Lychnothamnus* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 200, *pro parte*; id., Consp. syst. Charac. europ., 1867, p. 3; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 798, 1868.

Stem imperfectly corticate. *Stipulodes* in a single row, well developed. *Branchlets* ecorticate consisting of 3—5 articulations. *Bract-cells* 4—7 at each branchlet-node. *Bracteoles* 2. *Antheridia* at either side of each oogonium, proceeding from separate peripheral cells of the branchlet-node on either side of the cell which produces the oogonium; oogonium solitary.

Distribution. Only one species in fresh water of Europe and India.

1. **Lychnothamnus barbatus**[1]) (MEYEN) VON LEONHARDI in Verh. naturf. Ver. Brünn 2, 1864, pp. 40, 58; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 362, 371; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 597; AGHARKAR & KUNDU in Journ. Dep. Sci. 1, 1937, p. 10 — *Chara barbata* MEYEN in Linnaea 2, 1827, p. 75, pl. 3, figs. 7, 8; KUETZING, Tab. Phyc. 7, 1857, pl. 44, f. 1; WALLMAN in Act. Soc. Lin. Bordeaux 21, 1856, p. 45.

Plant monoecious, stout, c. 25 cm high. *Internodes* in the lower parts of the plant c. 10 cm long, in the upper parts as long as the branchlets. *Cortex* only present on the younger internodes of the stem. *Spine-cells* rudimentary. *Stipulodes* in a single whorl, twice as numerous as the branchlets, up to 1 cm long. *Branchlets* 7—10 in a whorl, consisting of 3—5 articulations; fertile branchlets more compact than the sterile ones. *Bract-cells* 4—7. *Bracteoles* 2. ♂ and ♀ *gametangia* at the three lowest nodes of the branchlets, not at the base of the whorls, at each

[1]) The literature here mentioned concerns only our area; for further titles, synonyms and illustrations I refer to BRAUN & NORDSTEDT (1882, p. 104) and MIGULA (1897, p. 287).

node one oogonium between two antheridia. *Antheridia* 200—250 μ in diam. *Oospores* dark reddish-brown, 660—720 μ long. *Membrane* tuberculate.

Remarks. The situation of the gametangia presents the most remarkable characteristic of this species. No Malaysian specimens examined.

Ecology. Very frequent in deep water of lakes and ponds. Ripe gametangia are found from December to April (ALLEN, 1925, pl. 5).

Distribution. Between 54° N. and 20° N.; EUROPE — ASIA, India.

6. CHARA VAILL. ex L., emend. AG., A. BR., VON LEONH.

Genus CHARA VAILLANT in Mém. Acad. Roy. Sci. Paris, 1719, p. 17; LINNAEUS, Gen. Plant. ed. 5, 1754, p. 491; PERSOON, Syn. Plant., 1807, p. 530, *pro parte*; AGARDH, Syst. Alg., 1824, p. XXVII; KUETZING, Phyc. Gen., 1843, p. 319; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 39; VON LEONHARDI in Lotos 13, 1863, repr. p. 12, *pro parte*; id. in Verh. naturf. Ver. Brünn 2, 1864, repr. p. 41, *pro parte*; A. BRAUN in HOOKER, Handb. New Zealand Fl., 1867, p. 550; id. in COHN, Krypt. Fl. Schles. 1, 1876, p. 402, *pro parte*; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 105; T. F. ALLEN, Charac. America 1, 1888, p. 52; MIGULA, Die Charac., 1897, p. 299; DE WILDEMAN, Alg. Fl. Buitenz., 1900, p. 372; ROBINSON in Bull. New York Bot. Gard. 4, 1906, p. 254; RIDLEY in Journ. Straits Branch R. A. Soc. 80, 1919, p. 163; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, p. 10; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 361; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1935, p. 592; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 428; PAL in Journ. Linn. Soc., Bot., 49, 1932, p. 79; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 40; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, p. 3 — Gen. *Nitella* AGARDH, Syst. Alg., 1824, p. XXVII, *pro parte* — Sect. *Charae hypogynae* A. BRAUN in Ann. Sci. Nat. 1, sér. 2, 1834, p. 353; id. in Flora 18, 1835, pp. 12, 58; id. in Linnaea 17, 1843, p. 117 — Gen. *Charopsis* KUETZING, Phyc. Gen., 1843, p. 319, *pro parte* — *Chara* sect. *Charopsis* KUETZING ap. RUPRECHT in Beitr. Pfl. Russ. Reiches 3, 1845, p. 12 — *Chara* sect. *Chara* AGARDH ap. RUPRECHT in Beitr. Pfl. Russ. Reiches 3, 1845, p. 12 — *Chara* sect. *bracteatae* A. BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10, 1849, p. 13 — *Chara* subgen. *Chara* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, pp. 200, 294.

Stem and *branchlets* corticate or ecorticate. *Stipulodes* always present, sometimes rudimentary. *Branchlets* consisting of 5—14 articulations. *Bract-cells* 5—7, the posterior ones frequently reduced. *Bracteoles*

usually 2. ♂ and ♀ *gametangia* in the monoecious species arising from the same peripheral cell of the branchlet-node, taking the place of a bract-cell. *Antheridium* produced below the oogonium.

Remarks. As a basis for the primary division of the genus before 1849, the number of cortical cell-rows with regard to the number of branchlets was used. From that year onwards the development of the stipulodes in a single or in a double whorl afford the ground for the main division. This classification, with the addition of the series *Gymnobasalia*, is followed here:

I. Sect. *Haplostephanae*
- I. Subsect. *Ecorticatae*
- II. „ *Corticatae*
  - 1. Series *Gymnoclemae*
  - 2. „ *Gymnopodes*

II. Sect. *Diplostephanae*
- I. Subsect. *Haplostichae*
- II. „ *Diplostichae*
  - 1. Series *Tylacanthae*
  - 2. „ *Aulacanthae*
- III. Subsect. *Triplostichae*
  - 1. Series *Gymnocladia*
  - 2. „ *Phloeobasalia*
  - 3. „ *Gymnobasalia*

Distribution. About 90 species in fresh and brackish water, in all parts of the whorld.

Key to the sections.

1a. Stipulodes in a single whorl . . . . I. HAPLOSTEPHANAE
b. Stipulodes in a double whorl . . . . II. DIPLOSTEPHANAE

Key to the species and subspecies[1].

1a. Stipulodes in a single whorl (Haplostephanae) 2
b. Stipulodes in a double whorl (Diplostephanae) 15
2a. Cortex on stem and branchlets absent 3
b. Cortex on stem present, on branchlets absent or present 10
3a. Stipulodes opposite the branchlets 4
b. Stipulodes alternating with the branchlets 5
4a. Oogonia, but not antheridia at base of branchlet-whorls; bract-cells at ultimate node of branchlets well developed . . . . 6. *C. succincta*
b. Neither oogonia nor antheridia at base of branchlet-whorls; bract-cells lacking at ultimate node of branchlets . . . . 7. *C. pashanii*

[1]) Cf. footnote on p. 51.

5a. Plant dioecious 6
b. Plant monoecious 8
6a. Base of branchlet-whorls sterile; gametangia solitary . . . **4. C. fulgens**
b. Base of branchlet-whorls fertile; gametangia aggregated 7
7a. Bract-cells reduced or wanting, only microscopically visible . **1. C. australis**
b. Bract-cells well developed, macroscopically visible . . . . **2.** *C. Wallichii*
8a. Gametangia not produced at base of branchlet-whorls 9
b. Gametangia produced at base of branchlet-whorls . . . . **3. C. corallina**
9a. Gametangia aggregated; branchlets with a corona-like termination . . . . **5. C. Braunii**
b. Gametangia solitary; branchlets without a corona-like termination . . . . 8. *C. nuda*
10a. Cortex on branchlets imperfect (Gymnopodes) . . . **12. C. hydropitys**
b. Cortex on branchlets absent (Gymnoclemae) 11
11a. ♂ and ♀ gametangia produced at different branchlet-nodes . . . . **10. C. erythrogyna**
b. ♂ and ♀ gametangia produced at the same branchlet-nodes 12
12a. Bract-cells and spine-cells absent . . . . **11.** *C. burmanica*
b. Bract-cells and spine-cells present 13
13a. Ripe oospores golden-brown . . . . 9C. **C. fibrosa** ssp. **flaccida**
b. Ripe oospores black 14
14a. Stipulodes as numerous as the branchlets . . 9A. **C. fibrosa** ssp. **Benthamii**
b. Stipulodes twice as numerous as the branchlets . . . . 9B. **C. fibrosa** ssp. **gymnopitys**
15a. Cortical cell-series of stem as numerous as the branchlets (Haplostichae). Plant dioecious . . . . **13.** *C. canescens*
b. Cortical cell-series of stem more numerous than the branchlets. Plant monoecious or dioecious 16
16a. Cortical cell-series of stem twice as numerous as the branchlets (Diplostichae). Plant monoecious 17
b. Cortical cell-series of stem thrice as numerous as the branchlets (Triplostichae). Plant monoecious or dioecious 20
17a. Cortical-cells of primary series prominent; spine-cells on ridges (Tylacanthae) 18
b. Cortical-cells of secondary series more prominent; spine-cells in furrows (Aulacanthae) 19
18a. Cortex on branchlets absent . . . . **14.** *C. Grovesii*
b. Cortex on branchlets imperfect . . . . **15.** *C. contraria*
19a. Branchlets with two or more corticated articulations. Gametangia produced at branchlet-nodes giving rise to a cortex. Stipulodes ± developed . . . . 16A. *C. vulgaris* ssp. *eu-vulgaris*
b. Branchlets entirely ecorticate. Gametangia produced at branchlet-nodes not giving rise to a cortex. Spine-cells rudimentary . . . . 16B. *C. vulgaris* ssp. *squamosa*
20a. Cortex on branchlets absent (Gymnocladia) . . . . **17.** *C. Handae*
b. Cortex on branchlets imperfect 21

21a. Basal branchlet-articulation ecorticated (G y m n o b a s a l i a) . . . . 25. **C. zeylanica**
b. Basal branchlet-articulation corticated (P h l o e o b a s a l i a) 22
22a. Plant dioecious 23
b. Plant monoecious 25
23a. Whitish bulbils present at the lower nodes of the stem . . 18. *C. aspera*
b. Whitish bulbils absent 24
24a. Stipulodes much longer than the spine-cells, which are rudimentary . . . . 19. *C. infirma*
b. Stipulodes and spine-cells of equal length; both rudimentary . . . . 20. *C. connivens*
25a. Basal branchlet-articulation not diaphanous, long. Cortical cell-series of branchlets twice the number of bract-cells 26
b. Basal branchlet-articulation subdiaphanous, short. Cortical cell-series of branchlets thrice the number of bract-cells 27
26a. Primary cortical-cells of stem more prominent than secondary ones. Stipulodes elongated . . . . 22. *C. delicatula*
b. Primary cortical-cells of stem equally well developed as secondary ones. Stipulodes rudimentary . . . . 21. **C. globularis**
27a. Spine-cells absent . . . . 23. **C. inermis**
b. Spine-cells present . . . . 24. **C. brachypus**

I. Sectio H a p l o s t e p h a n a e A. BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10, 1849, p. 13; id. in HOOKER's Journ. Bot. 1, 1849, p. 200; id., id., p. 294; VON LEONHARDI in Lotos 13, 1863, repr. p. 13; id. in Verh. naturf. Ver. Brünn, 2, 1864, repr. p. 41; A. BRAUN, Consp. syst. Charac. europ., 1867, p. 3; id. in Monatsb. Kön. Akad. Wiss. Berlin f. 1867, p. 798, 1868; id. in COHN, Krypt. Fl. Schles. 1, 1876, p. 403; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 17; T. F. ALLEN, Charac. America 1, 1888, p. 53; H. & J. GROVES in URBAN, Symb. Antill. 7, 1911, p. 31; NORDSTEDT in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 4; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, p. 11; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 363; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 429; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 60; PAL in Journ. Linn. Soc., Bot., 49, 1932, p. 65; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 53; ZANEVELD in Blumea 3, 1939, p. 381 — *Stenartreae* GANTERER, Oesterr. Charen, 1847, p. 12 — *Chara* subgen. *Charopsis* VON LEONHARDI in Lotos 13, 1863, repr. p. 13 — *Chara* sect. *Charopsis* VON LEONHARDI in Verh. naturf. Ver. Brünn 2, 1864, repr. p. 41.

Stipulodes in a single row, frequently well developed, sometimes rudimentary.

Key to the subsections.

1a. Stem and branchlets without cortical-cells . . . . I. ECORTICATAE
b. Stem corticate, branchlets ecorticate or imperfectly corticate . II. CORTICATAE

I. Subsectio ECORTICATAE A. BRAUN in HOOKER's Journ. Bot. 1, 1849, pp. 200, 203; id., id., p. 294; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 799, 1868; id. in COHN, Krypt. Fl. Schles. 1, 1876, p. 403; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 17; T. F. ALLEN, Charac. America 1, 1888, p. 53; NORDSTEDT in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 4; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 53; ZANEVELD in Blumea 3, 1939, p. 380 — *Chara* sect. *Heterosiphoniae* WALLROTH, Fl. Crypt. Germ., 1833, p. 107 — *Chara hypogynae* sect. *Monosiphoniae* A. BRAUN (non WALLROTH) in Ann. Sci. Nat. 1, sér. 2, 1834, p. 353 — *Charopsis* subsect. *Ecorticatae* VON LEONHARDI in Lotos 13, 1863, repr. p. 13 — *Euchara* subsect. *Ecorticatae* VON LEONHARDI in Verh. naturf. Ver. Brünn 2, 1864, p. 42.

Cortical-cells on stem and branchlets lacking.

1. **Chara australis** R. BROWN, Prodr. Fl. Nov. Holl. 1, 1810, p. 346; A. BRAUN in Linnaea 17, 1843, p. 117; id. in LEHMANN's Plant. Preiss. 2, 1847, p. 284; id. in HOOKER's Journ. Bot. 1, 1849, p. 200; KUETZING, Spec. Alg. 1849, p. 519; WALLMAN in Vet. Akad. Handl. 1852, p. 284; id. in Act. Soc. Linn. Bordeaux 21, 1856, p. 47; A. BRAUN in HOOKER's Flora Tasman. 2, 1860, p. 159; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, 1868, p. 799 (*nom. tant.*); BRAUN & NORDSTEDT in Kön. Akad. Wiss. Berlin, 1882, p. 105; T. F. ALLEN, Charac. of Amer. 1, 1888, p. 53 (*nom. tant.*); HOLTZ in Mitt. Naturw. Ver. Neuvorpommern u. Rügen 36, 1905, p. 38; BAILEY, Compreh. Catal. Queensl. Pl., 1909, p. 678 (*nom. tant.*); NORDSTEDT in Proc. Roy. Soc. Vict. 31, 1918, p. 4 (*nom. tant.*); J. GROVES in Philipp. Journ. Sci. 19, 1921, p. 664; in Journ. Linn. Soc., Bot., 46, 1922, p. 70; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1937, pp. 53, 54; HASSLOW, in Bot. Not., 1939, p. 301 — *Nitella pachyarthra*; *Nitella Stuartiana*; *Tolypellopsis simplicissima*; *Chara Stuartiana*; *Chara plebeja*; cf. varieties.

Plant dioecious, bright-green or brownish-green to almost white in the hyaline variety *lucida*, up to 35 cm high, not at all incrusted, therefore in a dried state very much flattened. *Stem* very stout (3.5 mm in diam. in f. *Stuartiana*) to slender (viz. 250—750 μ in var. *lucida*). *Internodes* $\frac{1}{2}$—2 times as long as the branchlets. *Cortex* and *spine-cells* absent. *Stipulodes* very small and conical acute, up to c. 180 μ long

and c. 80 μ wide at base, single or in pairs, but always alternating with the branchlets. *Branchlets* 3—8 in a whorl, 0.5—4.5 cm long, consisting of 3—5, sometimes very swollen articulations, ultimate articulation very short, frequently conical, acute, somewhat curved, rarely obtuse (var. *plebeja*). *Bract-cells* not always developed, sometimes 3 present (130—300 μ long, 20—50 μ wide at base), at the ultimate node, however, frequently lacking. *Bracteoles,* if any, usually 1—2, similar to the bract-cells. ♂ and ♀ *gametangia* produced in great clusters at the base of the whorls, and 1—3 at the nodes of the branchlets, except the ultimate one. *Antheridia* when fresh red, 660—1250 μ in diam. *Oogonia* 800—1000 μ long (inclus. coronula), 530—740 μ wide; *spiral-cells* showing 7—9 broad convolutions; *coronula* 70—90 μ high, 140—250 μ wide at base, individual cells blunt at their apices, straight or spreading; *oospores* black, 550—800 μ long, 330—510 μ wide, with 7—8 ridges. *Bulbils* found in one specimen of the var. *nobilis* only.

Remarks. *Chara australis* is much variable in habit; the diam. of the stem of f. *tenerior* is only c. 325 μ, whereas that of f. *Stuartiana,* to which the most gigantic *Chara* specimens belong now known to exist, reaches a diam. of 3.5 mm. In table XII a review is given of the characters of the different varieties in my opinion worth while to

TABLE XII.

Characters \ Varieties	α *nobilis*	β *lucida*	γ *Vieillardii*
Habit	stout to robust	rather stout	fairly robust
Appearance	not glossy	extremely glossy	not glossy
Stem-diam. in mm	1—3.5	0.25—0.75	0.45—1.5
Internodes (w. r. t. length of branchlets)	$\frac{1}{2}$—2 × as long	$\frac{1}{2}$ × as long	1 × as long
Number of branchlets	3—6	6	6—8
Length of branchlets in cm	2—3	0.6—1.5	1.5—4.5
Number of articulations	3—5	5	4—5
Antheridia (diam. in μ)	800—1250	550—960	750—1250
Oospores (length in μ)	660—730	550—660	712—756

distinguish, though there is no sharp break, especially between the varieties *lucida* and *Vieillardii.*

BRAUN first distinguished *C. plebeja* as a separate species (1843, p. 118) but afterwards it was cited by this author as a subspecies (1882, p. 107). The characteristic feature by which it is distinguished from the other varieties of *C. australis* is the small and obtuse ultimate branchlet-articulation, though for the rest it is hardly different from var. *Vieillardii.* In my opinion it is best considered a variety, but as I did not see a specimen I should reserve decision.

C. australis is most nearly allied to *C. Wallichii* from which it may be distinguished by the bract-cells being visible with the naked eye. Another nearly related species, which it resembles much, moreover, in appearance is *C. corallina,* but this is monoecious.

During a long lapse of time *C. australis* was considered endemic in Australia and in some of the adjacent Eastern islands. However, in 1921 it was recorded by GROVES from Annam (Indo-China), and the present paper shows that it occurs in Sumatra and New Guinea.

E c o l o g y. In bays, tributaries, waterholes in rivers, at the base of a cataract, the last two being habitats with more or less rapidly flowing water. In one case *Brasenia peltata,* a *Nymphaeacea,* is quoted as an inhabitant of the same locality, whereas *Chara fibrosa* ssp. *flaccida* and *C. zeylanica* are also found growing together. Plants with ripe gametangia are collected from November to July.

D i s t r i b u t i o n. Between 13° N. and 50° S.; circumtropic and Southern Temperate extending from Asia, Indo-China (GROVES, 1921, p. 664) southeastwards to Australia and New Zealand (cf. varieties).

var. α **nobilis** A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 105.

Plants very stout to robust, greyish green. *Stem* 1—3.5 mm in diam. *Internodes* ½—2 times the length of the branchlets, heavily swollen and contracted in the nodes. *Branchlets* 3—6 in a whorl, 2—3 cm long, 1—3 mm in diam., consisting of 3—5 articulations. *Bract-cells* and *bracteoles* 180 –300 μ long. *Antheridia* 800—1250 μ in diam. *Oogonia* 880—1000 μ long (incl. coronula), 670—740 μ wide; *coronula* 70—80 μ high, 140—200 μ wide at base; *oospores* 660—740 μ long, 480—510 μ wide. *Root-bulbils,* occurring in but one specimen, spherical, and present in clusters of 4—10 proceeding from the root-nodes.

R e m a r k s. BRAUN has not cited BROWN's original specimen from "New Holland" under one of his varieties in the "Fragmente". However, as the specimens signed by BRAUN: "*nobilis*", are quite identic

with the type specimen of BROWN, the var. *nobilis* must be considered the typical one of the species.

Distribution. Between 20° S. and 45° S.; AUSTRALIA, Tasmania. Moreover in lit.: New Zealand, BRAUN & NORDSTEDT (1882, p. 105), NORDSTEDT (1889, p. 31).

f. 1. **typica** ZANEV., nov. form. — *Chara australis* R. BR. var. *nobilis* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 105; KUETZING, Tab. Phyc. 7, 1857, p. 11; NORDSTEDT in Hedwigia 70, 1888, p. 187; id. in Acta Univ. Lund. 25, 1889, p. 31; BAILEY, Compreh. Catal. Queensl. Pl., 1909, p. 678 — *Nitella pachyarthra* F. VON MUELLER in herb. Berolin.

Illustration. KUETZING, Tab. Phyc. 7, 1857, pl. 27, f. 2.

Planta robusta. *Caulis* 1—1.5 mm diam. *Internodia* quam ramuli ½—1-plo longiora, valde tumida. *Verticillorum ramuli* 5—6, ad 2 cm longa, c. 1 mm diam., 4—5 articulationibus. *Bracteae* et *bracteoli* c. 180 μ longi. *Antheridia* 180 μ diam.

Plants very stout. *Stem* 1—1.5 mm diam. *Internodes* ½—1 times as long as the branchlets, heavily swollen. *Branchlets* 5—6 in a whorl, up to 2 cm long, c. 1 mm in diam., showing 4—5 articulations. *Bract-cells* and *bracteoles* c. 180 μ long. *Antheridia* 800—1000 μ in diam.

WEST AUSTRALIA: S. W. Division, Swan River, 1845, DRUMMOND s.n., herb. HOOKER in (B), ♂ and ♀; ibid., without date, DRUMMOND 228 (B), ♀; Queensland: Upper Brisbane River, no date, HARTMAN 305 (B), ♂; Australia felix, no date, F. VON MUELLER s.n., herb. SONDER in (B), ♂ and ♀; ibid., 1854, F. VON MUELLER s.n. (B), ♂; ibid., no date, F. VON MUELLER s.n. (B), ♂, with a remark by NORDSTEDT: "stipula bina alternantes"; ibid., no date, LEICHH. (= LEICHHARDT?) coll. s.n. (B), ♀ juv.[1]); E. coast of New Holland, 1802—'03, R. BROWN s.n. (B), ♂, fragments of the *type*[2]); New South Wales: Paramatta, c. 1867, W. WOOLS s.n. (B), ♂; ibid., without exact locality, Mr BALFOUR's waterholes in the river, 17 XI 1843, no collector's name (B), ♀; Victoria: Honeysuckle Creek, in deep places of the river, 4 II 1853, F. VON MUELLER s.n. (B), ♂ and ♀[3]); ibid., without exact locality, 1858, F. VON MUELLER s.n. (B), ♂.

TASMANIA: without exact locality, 1858, GUNN 1000, herb. HOOKER in (B), ♂, 4 specimens one with bulbils; ibid., Launceston, bason of the cataract, no date and collector's name (B), ♂.

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[1]) On the same sheet is a fragment belonging to this variety without mentioning the locality, enclosed in a cover on which is written: "*Nitella translucens* ? growing under *Brasenia peltata*".

[2]) ROBERT BROWN collected in tropical North Australia near Endeavour River, and in New South Wales near Port Jackson.

[3]) On the same sheet is another label on which Baron VON MUELLER himself wrote: "*Nitella pachyarthra*. In lacunis fluvii Broken River 4, Dr M.".

Remarks. The name suggests the most striking feature of this form for which ROBERT BROWN's plant is the type. KUETZING remarks to plate 27, f. 2 (1857, p. 11): "Bracteen fehlen gänzlich", however, this is not correct, as I have observed them.

Distribution. Between 20° S. and 45° S.; AUSTRALIA, S.W. Division, Queensland, New South Wales, Victoria; Tasmania. Moreover in lit.: New Zealand, BRAUN & NORDSTEDT (1882, p. 105), NORDSTEDT (1889, p. 31).

f. 2. **Stuartiana** (KUEZTING) ZANEV., nov. comb. — *Nitella Stuartiana* KUEZTING, Tab. Phyc. 7, 1857, p. 11 (non est *N. Stuartii* A. BR. = *N. congesta* A. BR.); BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 105 — *Chara Stuartiana* KUETZING in herb. SONDER in (B); BRAUN in Linnaea 25, 1852, p. 707.

Illustration. KUETZING, Tab. Phyc. 7, 1857, pl. 28, f. 1[1]).

Plant extremely robust. *Stem* 1.5—3.5 mm in diam. *Internodes* up to twice as long as the branchlets, very much swollen. *Branchlets* 3—5 in a whorl, 2—3 cm long, 1.5—3 mm wide, consisting of 3—4 heavily swollen articulations. *Bract-cells* and *bracteoles* c. 300 μ long. *Antheridia* c. 1250 μ in diam. *Oogonia* absent.

TASMANIA: South Esk River, "in flumine", no date, STUART s.n., herb. SONDER in (B, L), ♂, fragments of the *type* (probably STUART 1565, cf. BRAUN, 1852, p. 707); ibid., STUART s.n., without the remark: "herb. SONDER", (B), ♂.

Remarks. This form represents the largest *Chara*, and is at once recognized by its extremely robust habit, the extraordinarily swollen articulations and stem-internodes contracted into the nodes, and the 3—5 branchlets.

Distribution. Between 40° S. and 42° S.; AUSTRALIA, Tasmania.

var. β **lucida** A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 106; BAILEY, Compreh. Catal. Queensl. Pl., 1909, p. 678.

Plants very glossy, transparent and flexible, if a number of plants are taken together the colour is brownish green. *Stem* slender to moderately stout, 250—750 μ in diam. *Internodes* half as long as the branchlets, cylindrical and hardly contracted into the nodes. *Branchlets* 6 in a whorl, 0.6—1.5 cm long, up to 0.5 mm in diam., composed of 5 articulations. *Bract-cells* and *bracteoles* c. 180 μ long. *Antheridia* 550—960 μ in diam. *Oogonia* 800—900 μ long (incl. coronula), 530 -

[1]) In contradistinction to KUETZING's statement to this plate again that no bract-cells are extant, I must remark that I have seen them.

580 μ wide; *coronula* c. 90 μ high and c. 160 μ wide at base; *oospores* 550—660 μ long, 370—490 μ wide.

Remarks. The variety *lucida* is especially characterized by its glossy appearance. The New Guinea find is an interesting one for the extension of the area known for the collective species.

Distribution. Between 0° and 40° S.; ASIA, New Guinea — AUSTRALIA.

f. 1. **typica** ZANEV., nov. form.

Planta mediocriter robusta. *Caulis* ad 750 μ diam. *Verticillorum ramuli* ad 1.5 cm longa, 0.5 mm diam. *Antheridia* 660—960 μ diam.

Plant rather stout. *Stem* up to 750 μ in diam. *Branchlets* up to 1.5 cm long, 0.5 mm in diam. *Antheridia* 660—960 μ in diam.

N. E. NEW GUINEA: Morobe District, Wareo, 2000 m alt., 2 I 1936, CLEMENS 1459 (B), ♂ and ♀.

SOUTH AUSTRALIA: Northern Territory, Baines Creek, V 1856, F. VON MUELLER 5 (B), ♂ and ♀; ibid., Victoria River, no date, F. VON MUELLER 5 (B), ♂ and ♀, *type*.

Remarks. Distinguished from f. *tenerior* in being much more robust.

Distribution. Between 0° and 40° S.; ASIA, New Guinea — AUSTRALIA.

f. 2. **tenerior** A. BRAUN (in herb.), nov. form.

Habitus varietatis *lucidae*, sed in omnibus partibus minor. *Caulis* ad 350 μ diam. *Verticillorum ramuli* 6 mm longi. *Antheridia* 600 μ diam.

Habit as var. *lucida*, but much more slender. *Stem* up to 350 μ in diam. *Branchlets* not longer than 6 mm. *Antheridia* 600 μ in diam.

N. AUSTRALIA: Gulf of Carpentaria, without exact locality, 1856, F. VON MUELLER s.n. (B), ♂, *type*.

Remarks. As the specimens are distinctly recognizable by their small appearance, it seems worth while to distinguish this form. Only male plants collected.

Distribution. Between 10° S. and 20° S.; AUSTRALIA, Gulf of Carpentaria.

var. γ **Vieillardii** [1]) A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 106.

Plants brownish green, transparent, not distinctly glossy. *Stem*

[1]) BRAUN writes in the "Fragmente" (1882, p. 106): *"Viellardi"*, however the spelling of this name must be an orthographic error, as the plant was named after its collector E. VIEILLARD. In accordance with the International Rules (1935, art. 70) I write *"Vieillardii"*.

slender to stout, 450—1500 μ in diam. *Internodes* as long as the branchlets, not swollen, not contracted into the nodes. *Branchlets* 6—8 in a whorl, 1.5—4.5 cm long, 0.5—1.25 mm in diam., showing 4—5 articulations, the ultimate one sometimes conical. *Bract-cells* and *bracteoles* more or less rudimentary and even up to 250 μ long. *Antheridia* 750—1250 μ in diam. *Oogonia* 1025 μ long (incl. coronula); 620—670 μ wide; *coronula* c. 130 μ high, c. 140 μ wide at base; *oospores* 712—756 μ long, 490—534 μ wide.

Remarks. This variety can be distinguished from var. *lucida*, which has nearly the same habit, by its not being distinctly glossy.

Distribution. Between 3° N. and 40° S.; ASIA, Sumatra — AUSTRALIA, New Caledonia, Fiji Islands. Moreover in lit.: New Zealand, cf. f. *typica*.

f. 1. **typica** ZANEV., nov. form. — *Chara australis* R. BROWN var. *Vieillardii* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 106; NORDSTEDT in Hedwigia 70, 1888, p. 188; id. in Acta Univ. Lund. 25, 1889, p. 32.

Illustration. BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pl. 7, f. 195.

Planta mediocriter robusta, translucens, flexilis. *Verticillorum ramuli* 6, 2.5—3 cm longi, 1.25 mm diam., 5-articulati. *Bracteae* et *bracteoli* c. 250 μ longi. *Antheridia* 750—1250 μ diam.

Plants fairly stout and flexible, transparent. *Stem* 1—1.5 mm in diam. *Branchlets* 6 in a whorl, 2.5—3 cm long, 1.25 mm in diam., showing 5 articulations. *Bract-cells* and *bracteoles* c. 250 μ long. *Antheridia* 750—1250 μ in diam.

NEW CALEDONIA: Pancher, 1869, F. VON MUELLER s.n. (B), ♂ and ♀, juv.

Remarks. The typical form and f. *simplicissima* are distinguished from f. *vitiensis* by having only one stipulode to each branchlet. Forma *typica* has the most robust habit of the three.

Distribution. Between 20° S. and 40° S.; New Caledonia. Moreover in lit.: New Zealand, NORDSTEDT (1889, p. 32).

f. 2. **vitiensis** NORDSTEDT in Hedwigia 70, 1888, p. 188; id. in Forschungsreise S. M. S. "Gazelle" 4, 1889, p. 8.

Illustrations. NORDSTEDT in Hedwigia, 70, 1888, pl. 6, figs. 3—6.

Stem up to 760 μ in diam. *Internodes* as long as the branchlets. *Branchlets* 6—8 in a whorl, c. 4.5 cm long, 800 μ in diam. consisting of 5 articulations. *Bract-cells* 2 and *bracteoles* 1, c. 130 μ long. *Antheridia* 750 μ in diam.

FIJI ISLANDS: Oralau, in the marshes near Bureta, VI 1882, WEBER s.n. (B), ♂ and ♀, *type*; ibid., Leruka, XI 1875, NAUMANN s.n.[1]) (B), ♂.

Remarks. This form was separated by NORDSTEDT on account of the presence of two stipulodes at the base of each branchlet. It is an extremely slender form with proportionally long branchlets and internodes. The type possesses only very young oogonia, and the other plant is a male plant, therefore no dimensions of the oogonia can be given.

Distribution. Between 16° S. and 20° S.; Fiji Islands.

f. 3. **simplicissima** (FILARSZKY) ZANEV., nov. comb. — *Tolypellopsis* (*Nitellopsis*) *simplicissima* FILARSZKY in Arch. f. Hydrobiol. 1934, Suppl. Bd. 12, Trop. Binnengew. Bd. 4, p. 716; id. in Math. u. Naturw. Anz. Ung. Akad. Wiss. 52, 1935, p. 468 (*nom. tant.*).

Illustrations. FILARSZKY, *l. c.,* figs. 51—57; the pres. paper, f. 9*a*.

Differt ab varietate *Vieillardii* habitate tenuiori et rigidiori. *Caulis* ad 500 μ diam. *Verticillorum ramuli* 6—8, 1.5 cm longi, 0.5 mm diam., 4 articulationibus, segmento ultimo conico. *Bracteae* et *bracteoli* c. 90 μ longi.

Differs from variety *Vieillardii* by the more slender and the stiff habit. Diam. of the *stem* up to 500 μ. *Branchlets* (4—)6(—8) in a whorl, c. 1.5 cm long, 0.5 mm in diam., showing 4 articulations of which the ultimate one is cone-shaped. *Bract-cells* and *bracteoles* usually lacking, if any, up to 90 μ long.

SUMATRA: Tapanoeli, Lake Toba, S. W. part of the Porsea basin, from 3 m depth, alt. 900 m, 8 IV 1929, German Limnol. Sunda Exped. TP1d (Bu-Mus), *type*, mixed with the formalin and dried material of FILARSZKY's No. 4 (1934, p. 711), only oogonia are present and on the lowest nodes bulbils were found; ibid., Batakdistricts, 16 VII 1904, VAN DAALEN 539a (Bz, L), ♂ and ♀, together with *Chara fibrosa* ssp. *flaccida* and *C. zeylanica*.

Vernacular name: limoet (cf. lomotra, ZANEVELD, 1939, p. 376).

Remarks. This form is to be distinguished from the typical form by the smaller habit and by having more branchlets in a whorl. The stipulodes and bract-cells are hardly developed or they are rudimentary as is the case in the specimens of the Sunda Expedition.

At the end of the type description of *Tolypellopsis simplicissima*, FILARSZKY (1934, pp. 716—717) states already that the plants from the

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[1]) According to NORDSTEDT (1888, p. 188) NAUMANN is the collector.

Porsea-basin were quite identic with *Chara australis* R. BROWN. Only relying on KUETZING's figures (1857, pl. 27, f. 2, pl. 28, f. 1) and not on the specimens themselves, FILARSZKY concludes that *C. australis* and *C. Stuartiana* do not belong to the genus *Chara* but to *Nitellopsis* (= *Tolypellopsis*), and he rejects the correctness of the note in BRAUN & NORDSTEDT (1882, p. 109), where KUETZING's remark that the bract-cells are absent, is contradicted. In studying the same specimens as figured by KUETZING, it is without any doubt as I already pointed out (p. 126) that in those specimens the bract-cells are present. However, it is possible that they are lacking and this is the case in FILARSZKY's specimens. A close examination of FILARSZKY's *Tolypellopsis (Nitellopsis) simplicissima* leads me to the conclusion that it is a synonym of *Chara australis,* but it may be considered a separate form.

Ecology. The badly preserved specimens are densely covered with clay and therefore they look somewhat unusual. To the specimens from the Porsea-basin is added: temp. of surface 35°—27° C., pH 8.3, alkalinity 1.56, conductivity 1.33 . 10^{-4}. Other species of the same locality are *Chara fibrosa* ssp. *flaccida* and *C. zeylanica.*

Distribution. Between 2° N. and 3° N.; ASIA, Malaysia, Sumatra.

Var. δ **plebeja** A. BRAUN in Abh. Kön. Akad. Wiss. Berlin 1882, p. 107, pl. 7, f. 196; id. in LEHMANN's Plant. Preiss. 2, 1847, p. 148 — *Chara plebeja* R. BROWN *ined.*, ex A. BRAUN in Linnaea 17, 1843, p. 118; id. in HOOKER's Journ. Bot. 1, 1849, p. 201; KUETZING, Spec. Alg. 1849, p. 519; T. F. ALLEN, Charac. Americ. 1, 1888, p. 53 *(nom. tant.)*; NORDSTEDT in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 4 *(nom. tant.)*.

The terminal articulation of the branchlets is obtuse and not apiculate or acute.

Remarks. NORDSTEDT (1882, p. 107) states that BRAUN has cited this variety in his manuscript as "*γ plebeja*", however, on account of BRAUN's remark in Charac. Afrik. (1868, p. 799): "*Ch. australis* cum subsp.", NORDSTEDT has cited this variety in "Die Fragmente" as a subspecies. With regard to the characteristics and the Greek type γ I think that BRAUN may later on have considered it a variety and therefore I give it that rank. No specimens seen.

Distribution. Between 10° S. and 30° S.; AUSTRALIA: North coast, BRAUN (1843, p. 118), KUETZING (1849, p. 519), BRAUN & NORDSTEDT (1882, p. 107).

2. Chara Wallichii A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 17, 107, pl. 7, figs. 197—198; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 799, 1868 *(nom. tant.)*; T. F. ALLEN, Charac. America 1, 1888, p. 53 *(nom. tant.)*; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 363, 371; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 597, pl. 4; id. in Journ. Ind. Bot. Soc. 7, 1928, p. 60, f. 9; id. in Journ. Ind. Bot. Soc. 15, 1936, p. 52; PAL in Journ. Burma Res. Soc. 18, 1929, p. 113 *(nom. tant.)*; id. in Journ. Linn. Soc., Bot., 49, 1932, pp. 65, 79, pl. 14—15

Plant dioecious, bright to brownish-green, 15—25 cm high. *Stem* stout, 875—1000 μ in diam. *Internodes* ½—1 times the length of the branchlets. *Cortex* and *spine-cells* absent. *Stipulodes* rudimentary. *Branchlets* 5—6 in a whorl, straight, c. 1.5 cm long, consisting of 4—6 articulations, of which the second is the longest, and the ultimate one the shortest, though somewhat longer than the surrounding bract-cell(s). *Bract-cells* cone-like, 4 at the lower nodes, 3, 2, and 1 or 2 at the next nodes, gradually diminishing in length; the lowest bract-cells are c. 1068 μ long and c. 356 μ wide at base, the ultimate one(s) 445 μ long and c. 223 μ wide at base. The terminal node usually contains one bract-cell, but those with two are also present. *Bracteoles* usually 3, similar to the bract-cells. ♂ and ♀ *gametangia* sessile, produced at the base of the branchlet-whorls as well as at all branchlet-nodes. *Antheridia* 1—3 together, 790—900 μ in diam. *Oogonia* clustered, 840—900 μ long (incl. coronula), 630—700 μ wide; *spiral-cells* showing 7—8 convolutions; *coronula* 140—155 μ high, 200—235 μ wide at base, persistent, straight; *oospores* black, c. 500—610 μ long, 380—440 μ wide with 6—7 prominent ridges terminating in short claws.

INDIA: Gangetic Plain, Pirgunj, 9 I 1809, without collector's name, ex herb. Ind. Orient. Soc. Linn. Lond. (B), ♂, fragments of the *type*.

Remarks. The other dioecious species of the ecorticate *Haplostephanae* are but two in number. Now *Chara fulgens* has the base of the branchlet-whorls sterile, whereas *C. Wallichii* can be distinguished from *C. australis* by its smaller gametangia, a well developed terminal branchlet-articulation, and macroscopically visible bract-cells. These characters may also serve in distinguishing this species from the monoecious *C. corallina*.

Ecology. In growth-form *C. Wallichii* is a large, robust plant, rather spiky in appearance and very brittle (ALLEN 1928, p. 60). The plants grow in dense clumps in which other species are never found. When the environmental conditions are favourable this species is able to oust other plants in a pond as PAL (1932, p. 53) writes, for *C. Wallichii* at Toungoo, Burma, obtained complete possession of a pond in which a little earlier a rich vegetation of reeds, *Nymphaea*, *Salvinia*, etc. was present. Though it thus occurs in stagnant water, the species is also found growing in water that has an appreciable current (ALLEN, 1925, p. 598).

The few records indicate that *C. Wallichii* has fully mature oogonia in December and January in Burma and from October to December in the Gangetic Plain. According to PAL (*l.c.*, p. 51) the species is restricted entirely to lowland country. As epiphytes are recorded *Coleochaete* and *Diatomeae* species.

Distribution. Between 30° N. and 19° N.; ASIA, India: Gangetic Plain. Moreover in lit.: India, Lower Burma, PAL (1931, p. 79).

3. **Chara corallina** WILLDENOW in Mém. Ac. Roy. Berlin f. 1803, p. 89, 1805; id. in Samml. d. Abh. Kön. Akad. Wiss. Berlin f. 1803, p. 61, 1806; id., Spec. Plant. 4, 1805, p. 186; BRUZELIUS & FUERNROHR in Flora 9, 1826, p. 491; BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 294; KUETZING, Spec. Alg., 1849, p. 519; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 48; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 17, 108; T. F. ALLEN, Charac. America 1, 1888, p. 53 (*nom. tant.*); H. & J. GROVES in Philipp. Journ. Sci. 7, 1912, p. 69; MERRILL,

Spec. Blancoan. 1918, p. 40; J. GROVES in Journ. Linn. Soc., Bot., 46, 1922, p. 102; id. in Journ. Linn. Soc., Bot., 46, 1924, pp. 363, 371; G. O. ALLEN in Journ. Bomb. Nat. Hist. Soc. 1925, p. 52; GROVES & STEPHENS in Trans. Roy. Soc. S. Afr. 13, 1926, p. 154; GROVES & ALLEN in Journ. Bot. 65, 1927, p. 338; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 61; PAL in Journ. Burma Res. Soc. 18, 1929, p. 113 (*nom. tant.*); id. in Journ. Linn. Soc., Bot., 49, 1932, pp. 65, 80; DIXIT in Journ. Ind. Bot. Soc. 14, 1935, p. 258; G. O. ALLEN in Journ. Ind. Bot. Soc. 15, 1936, p. 52; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, p. 11 — *Chara congesta* SPRENG. var. P. Fr. ANTONIO LLANOS (non *C. congesta* R. BROWN = *N. congesta* A. BR.), Fragm. d. alg. plant. d. Filipinas, Manila 1851, p. 112 — *C. corallina* var.? *basilaris* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 108 — *Chara furcata* HORNEMANN, a name to be found on herbarium labels — *Chara moluccana* ZIPPELIUS in Herb. Lugd. Bat. — *Chara Roxburghii* A. BRAUN (non *N. Roxburghii* A. BR.) in Regensb. Bot. Zeit., 1835, p. 59 — *Nitella corallina* AGARDH, Syst. Alg., 1824, p. 123.

Illustrations. WILLDENOW in Mém. Ac. Roy. Berlin f. 1803, pl. 2, f. 2, 1805; id. in Samml. d. Abh. Kön. Akad. Wiss. Berlin f. 1803, pl. 2, f. 2, 1806; KUETZING, Tab. Phyc. 7, 1857, pl. 80; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pl. 7, f. 199; GROVES & STEPHENS in Trans. Roy. Soc. S. Afr. 13, 1926, pl. 14 (f. *mascarensis*); G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, f. 10 and pl. 6; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, pl. 5, figs. 3—6; the pres. paper, f. 12*a*.

Plant monoecious, bright to brownish-green, slightly annularly incrustated, flexible, up to 30 cm high. *Stem* moderately stout, 750—1205 μ in diam. *Internodes* 1—4 times the length of the branchlets. *Cortex* and *spine-cells* absent. *Stipulodes* rudimentary, alternating with the branchlets, if any, small and acute, c. 210 μ long, c. 150 μ wide at base [1]). *Branchlets* 6—8 in a whorl, c. 3 cm long, consisting of 4—5 swollen articulations, contracted into the nodes, the ultimate articulation, however, cone-shaped, variable in size, 45—255 μ long, 30—105 μ wide at base, apex acute and somewhat incurved, penultimate cell rounded at apex. *Bract-cells* 3(—4), small, acute, up to 210 μ long, c. 60 μ wide at base, sometimes lacking at the ultimate branchlet-node. *Bracteoles*

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1) In the HORNEMANN specimens extant in the Berlin herbarium (cf. also BRAUN, 1849, p. 295) the stipulodes have the extraordinary length of 750 μ and a breadth of 225 μ.

similar to the bract-cells or somewhat shorter, c. 150 μ long, c. 45 μ wide at base. ♂ and ♀ *gametangia* together (see remarks) in a great number at the base of the branchlet-whorls and solitary or geminate at the two lowest branchlet-nodes. *Antheridia* earlier ripe than oogonia, 530—675 μ in diam. *Oogonia* 925—1230 μ long (excl. coronula), 600—900 μ wide; *spiral-cells* showing 7—9 broad convolutions; *coronula* 150—180 μ high, 180—195 μ wide at base; individual cells in a young state diverging, when mature close together; *oospores* black, 645—875 μ long, 525—605 μ wide, with 6—7 ridges.

INDIA: Malabaria, Bombay, no date, POLYDORE ROUX s.n., ex herb. BOISVIN, com. GUILLEMIN (B); Coromandelia, Tranquebar, Wöppanpasi Tam, 7 I 1799, no collector's name, herb. G. VON MARTENS in (B), fragment of the *type* [1]); Bengal, without exact locality, 1869, c. KURZ 1924 (B); ibid., 1871, KURZ 2718(B); India orientalis, without indication of the locality and date, HORNEMANN s.n. (B); ibid., ex herb. LINK in (B); In Indiae aquis (KLEIN), without exact locality, date and collector's name, ex herb. WILLD., 1806—'12 (B), cf. BRAUN (1849, p. 295).

SIAM: Pak Raw, inside channel between two parts of Talé Sap, water 4—6 m, brackish, 25 I 1916, ANNANDALE 15 (Si), together with *Chara hydropitys* and *C. zeylanica*.

JAVA: Banjoemas, G. Dijéng (on the label: "Yang mount.") near Tamanhidoep, alt. 2200 m., VI 1928, GANDRUP s.n. (Bz), sterile and badly preserved specimen, therefore identification not certain.

BORNEO: W. Division, Bengkajang, III—IV 1863, Dr E. VON MARTENS s.n., ex herb. BRAUN in (B), "Unter *Nitella polyglochin* v. *Zollingeri*", four sterile specimens of which three have the remark "im Festungsgraben 22 - 3 - 63" and the fourth bears no annotations at all.

PHILIPPINE ISLANDS: without exact locality and date, LLANOS s.n., ex herb. DE CAND. 1855 in herb. A. BRAUN in (B), *type* of *Chara corallina* WILLD. var. *basilaris*, *C. congesta* LLANOS non R. BR. [2]).

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1) BRAUN (1849, p. 295) states that WILLDENOW gives Malabar as the type locality, but KLEIN wrote on a paper in WILLDENOW's herbarium: "Frankenb. 1799" and therefore BRAUN supposed that this must be "Tranquebar" on the coast of Coromandel, which is actually confirmed by a specimen in the Berlin herbarium.

2) This is the specimen mentioned by BRAUN & NORDSTEDT (1882, p. 108), GROVES (1912, p. 69) and MERRILL (1918, p. 40). In contradistinction to BRAUN's remark (1882, p. 108) I saw on a branchlet-node of the type an antheridium and a young oogonium. The var. *basilaris* must therefore be excluded as it was based on the absence of this particular. This specimen undoubtedly is *C. corallina* and not *C. zeylanica* as MERRILL (1918, p. 40) presumed. On the same herbarium sheet there is another specimen with the following note: "*Chara furcata* ROXB., ex herb. DESFONTAINE". Most probably this specimen was not collected in the Philippines (cf. also BRAUN, 1849, p. 295).

AMBOINA: in the lake of the Governor's garden, no date, ZIPPELIUS s.n. (L), very rich fertile material, mixed up with *N. pseudoflabellata* var. *mutila* [1]).

NEW CALEDONIA: Wagap, 1863, VIEILLARD 1984 ?, ex herb. KUETZING in (L).

Remarks. The present species is in a marked degree protandrious. Ripe antheridia and oogonia are hardly to be found at the same time. There is an interesting difference in the situation of the gametangia at the branchlet-nodes in *C. corallina* and other *Chara* species. The place of the antheridium at the branchlet-nodes is not below the oogonium as is usually the case in the genus *Chara*, but it is more or less obliquely situated. This may go so far that it sometimes looks as if the antheridium is attached beside the oogonium.

This also explains the situation of the bracteoles. Frequently one bracteole is normally situated above the antheridium, whereas the other one stands below the antheridium at the side of the oogonium. As GROVES & STEPHENS (1926, p. 154) already stated, it is easily to be seen that the ♂ and ♀ gametangia both proceed from the same peripheral cell of the branchlet-node. In the genus *Lychnothamnus* the normal position of the ♂ and ♀ gametangia is side by side, but in that genus the ♂ and ♀ gametangia are produced by different cells of the branchlet-node.

KUETZING (1857, pl. 80, figs. a and b) figures "Früchte in den Winkeln der Involucralblätter" to which BRAUN (1882, p. 108) remarks: "Ich sah blosz Antheridien Auszerhalb". Though this is the case in by far the most specimens, the oogonia are sometimes inserted outside the whorls as is also figured by AGHARKAR & KUNDU (1937, pl. 5, f. 3) and by ALLEN (1928, f. 10b). The plate of GROVES & STEPHENS (1926, pl. 14) shows figures (i. e. 2, 4, 5) with very small oogonia which have already a well developed series of crown-cells, which is always the case in this species.

C. corallina belongs to the group of ecorticate haplostephanous *Charas* of which six other ones are also distributed in the same area, all easily distinguishable. *Chara australis*, *C. Wallichii* are dioecious, *C. nuda* has always solitary gametangia, and *C. Braunii* and *C. fulgens* do not have the aggregated gametangia at the base of the branchlets, whereas *C. succincta* has the oogonia at the base of the whorls only.

The species was hitherto not recorded from Australia, therefore the specimen of VIEILLARD in the Leiden herbarium is of interest.

The variety *basilaris* LLANOS must be excluded as the type speci-

[1]) ZIPPELIUS visited Amboina in 1828.

men has the gametangia at the branchlet-nodes too; the absence of this characteristic was the main subject for establishing this variety.

GROVES & STEPHENS (1926, p. 154) designated provisionally a form *mascarensis*, which can be distinguished from the type in having usually a ring of bract-cells surrounding the final articulation, and in having more numerous stipulodes. As I did not see the specimen, no comments can be given, but the cited differences from the type seems to be very inconstant so that I believe it hardly necessary to maintain the form.

Ecology. *C. corallina* is usually a very large and robust but brittle plant. It sometimes reaches a length of 50 cm when growing amongst a thick vegetation, as in this case the internodes in the lower parts of the plants are considerably elongated. Another peculiarity for this species is the more or less contracted nodes and the swollen branchlet-articulations. When dried and not heavily pressed the specimens show a marked rippling, possibly due to the annular lime incrustation as the not incrusted clear green parts are heavier shrivelled up than the parts provided with calcium carbonate. Though BRAUN (1849, p. 295) declines the annular incrustation for this species it is often described (cf. ALLEN 1928, p. 61 and PAL, 1932, p. 80), and was noticed by the writer too in different specimens.

The species grows in largish clumps, in the stagnant water of ponds, pools, etc., but also in the typical "raos", torrent beds of the Saharanpur district. In the Toba lake it is mixed up with *Nitella sumatrana* and *C. zeylanica*, in Amboina with *N. pseudoflabellata* and in Siam with *Chara hydropitys* and *C. zeylanica*.

Malaysian plants bearing gametangia are found from March to July, they are, in India, at their best throughout the cold weather (ALLEN 1928, p. 61).

Chara corallina is probably most represented in mountainous areas; in Sumatra and Java it occurs at an altitude of 2200 m.

It is very seldom overgrown with green algae. DIXIT (1935, p. 258) mentions *Chaetophora elegans* ROTH. as being epiphytic. A number of *Hydra* and *Vorticella* species are also present on the thallus.

The ripe antheridia have a coral-red colour to which the specific name refers; they are found from January to July.

Distribution. Between 25° N. and 25° S.; ASIA, India: Malabaria, Coromandelia, Bengal; Siam; Malaysia: Java, Borneo, Philippine Islands, Amboina — AUSTRALIA, New Caledonia. Moreover in lit.: ASIA, Ceylon (GROVES, 1921, p. 102); Gangetic Plain:

Saharanpur, GROVES & ALLEN (1927, p. 338), ALLEN (1928, p. 61); Bareilly, ALLEN (1936, p. 52); Gonda, GROVES (1934, p. 372), ALLEN (1925, p. 597); Benares, Howrah, Mugra, Sucksagur, Calcutta, GROVES (1924, p. 372); Pegu: Kyantaw (= Kyeik-tau?); Malaysia: S. Andaman Islands, GROVES (1924, p. 372); Sumatra, GROVES & STEPHENS (1926, p. 154), GROVES & ALLEN (1927, p. 338), DIXIT (1935, p. 258) — AFRICA, Mascarene Islands, Mauritius, GROVES & STEPHENS (1926, p. 154).

4. **Chara fulgens** FILARSZKY in Arch. f. Hydrobiol. 1934, Suppl. Bd. 12, Trop. Binnengew. Bd. 4, pp. 720; id. in Math. u. Naturw. Anz. Ung. Akad. Wiss. 52, 1935, p. 468 (*nom. tant.*).

Illustrations. FILARSZKY, 1934, *l. c.*, figs. 66—70; the pres. paper, f. 10*a*.

Plant dioecious, bright-green, glossy, hyaline, flexible, probably c. 30 cm high (and more). *Stem* rather robust, up to 1000 μ in diam. *Internodes* very variable in length with respect to the length of the branchlets: in the lower parts of the plants very long, 4—6 cm, in the upper parts, 0.5—2 cm. *Stipulodes* alternating with the branchlets, conical, acute, c. 180 μ long, c. 35 μ wide at base. *Branchlets* 4—8 in the upper whorls, 4—6 in the lower ones, 0.5—2 cm long, consisting of 4—6 articulations of which the ultimate one is short; they are swollen and constricted into the nodes. *Bract-cells* (1—)3(—4), equally small, acute, much shorter than the oogonia, c. 125 μ long, 45 μ wide. *Bracteoles* similar to the bract-cells. ♂ and ♀ *gametangia* disjuncted, solitary at the first and second branchlet-nodes. *Antheridia* unknown. Ripe oogonia not known. *Oogonia* c. 900 μ long (excl. coronula); *coronula* c. 175 μ high, c. 180 μ wide at base, individual cells strongly divergent and egg-shaped.

BALI: S. Bali, Danaubratan, little caldera lake near Batoeriti, alt. 1231 m, depth 10 m, 15 VI 1929, German Limnol. Sunda Exp. BB2a (Bu-Mus), *type*, two specimens with very few ♀ fragments.

Remarks. I hesitated somewhat to describe this plant as a separate species on account of the following. It is quite similar to *C. australis* var. *Vieillardii*, except the lack of oogonia at the base of the whorls, and it also resembles very much *C. Braunii*, except its being dioecious.

FILARSZKY's description of this species was only based on two ♀ whorls preserved in fluid. Though I borrowed from the Museum of Budapest all the material of the German Limnol. Sunda Exp. these fragments were not to be found in the tube BB2a: this contained

only fragments of *Nitella mucronata* var. *pseudograciliformis,* with which it was found growing together. In the dried material, however, I saw another ♀ whorl with unripe oogonia situated in the same manner, viz. only at the branchlet-nodes. Therefore, and also in view of the theoretical possibility of the existence of this species as a combination of characters I consider it a separate species.

Ecology. The bright-green robust plant has a glossy appearance. When dried it has an almost white colour, which is probably not due to a heavy incrustation as this was not at all observed. It was collected together with *Nitella mucronata* var. *pseudograciliformis* in a caldera lake with a diam. of 2.6 km at an elevation of 1230 m. Temperature of the surface 22.1° C., alkalinity 0.16, pH 6.8.

Distribution. 8° S.; ASIA, Malaysia: Bali.

5. **Chara Braunii** GMELIN [1]), Flor. Badens. Alsat. 4 (suppl.), 1826, p. 646; BISCHOFF, Krypt. Gew., 1828, p. 26; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 49; NORDSTEDT, Australas. Charac. 1, 1891 (no page); ROBINSON in Bull. New York Bot. Gard. 4, 1906, p. 258; H. & J. GROVES in URBAN, Symb. Antill. 7, 1911, p. 38; id. in Philipp. Journ. Sci. Bot. 7, 1912, p. 70; NORDSTEDT in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 5; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 363, 372; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 599; GROVES & ALLEN in Journ. Bot. 65, 1927, p. 338; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 61; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 55; DIXIT in Journ. Ind. Bot. Soc. 14, 1935, p. 258; G. O. ALLEN in Journ. Ind. Bot. Soc. 15, 1936, p. 51; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, p. 12 — *Chara coronata* ZIZ. (ined., c. annum 1814); BISCHOFF, Krypt. Gew. 1828, p. 26; WALLROTH, Flor. Crypt. Germ., 1833, p. 107; BRAUN in Flora 18, 1835, p. 59; GANTERER, Oesterr. Charen, 1847, p. 13; BRAUN in Schweiz. Charac., 1849, p. 13; id. in HOOKER's Journ. Bot. 1, 1849, p. 295; KUETZING, Spec. Alg. 1849, p. 520; A. BRAUN, Consp. syst. Charac. europ., 1867, p. 4; id. in Monatsber. Kön. Akad. Wiss. Berl. f. 1867, p. 897, 1868; T. F. ALLEN in Americ. Natur. 16, 1882, p. 358; A. BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 17, 108; NORDSTEDT in Acta Univers. Lund 25, 1889, p. 32; MIGULA, Syn. Charac. europ. 1898, p. 72; DE WILDEMAN, Alg. Fl. Buitenz., 1900, p. 372; MIGULA

[1]) From Europe only the principal papers are cited, for further literature cf. MIGULA, Die Charac. Deutschl., 1897, p. 321 and GROVES & BULLOCK WEBSTER, The British Charoph. 2, 1924, p. 11.

in Hedwigia 70, 1931, p. 215 — *Nitella Braunii*; *Charopsis Braunii*; *Chara oahuensis*; *Chara coronata* var. *Junghuhniana*, var. *leptosperma*, var. *leptosperma* f. *javanica*, var. *leptosperma* f. *oahuensis*, var. *Meyenii*, var. *oahuensis*, var. *orientalis*, var. *pachysperma* f. *leptocoronulata*, et. varieties.

Illustrations. BISCHOFF, Krypt. Gew., 1828, pl. 1, figs. 5, 7; KUETZING, Tab. Phyc. 7, 1857, pl. 43, f. 1; T. F. ALLEN in Americ. Natur. 16, 1882, figs. 1—11; NORDSTEDT, Australas. Charac. 1, 1891, pl. 7, figs. 1—6; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, pl. 3; id. in Journ. Ind. Bot. Soc. 7, 1928, f. 11; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, pl. 5, figs. 7—10, pl. 6, figs. 1—14.

Plant monoecious, bright-green, up to 35 cm high, smooth and flexible, therefore *Nitella*-like, not at all incrustated. *Stem* rather slender, c. 500 μ in diam. *Internodes* variable in length, usually as long as the branchlets or somewhat shorter. *Cortex* and *spine-cells* absent. *Stipulodes* in a single whorl, as numerous as the branchlets and alternating, c. 475 μ long, c. 130 μ wide, acute. *Branchlets* 8—11, up to 3.5 cm long, consisting of 4—6 articulations, the lower 3—5 elongate, the ultimate very short. *Bract-cells* 3—4, small, acute, 330 μ long, 75 μ wide, at the terminal node forming together with the small terminal articulation a 3—5-celled corona-like termination; posterior bract-cell(s) very short or lacking, anterior ones about equalling the oogonium, rarely longer, often shorter. *Bracteoles* usually somewhat longer than or equal to the oogonia, similar to the anterior bract-cells. ♂ and ♀ *gametangia* at the first, second or third lowest node but not at the base of the branchlet-whorls, solitary, seldom double or triple, at the same nodes. *Antheridia* 225—415 μ in diam. *Oogonia* c. 750 μ long, c. 500 μ wide; *coronula* much varying in height (80—225 μ); *spiral-cells* showing 8—13 convolutions; *oospores* black, 425—750 μ long, 300—575 μ wide; with 7—12 inconspicuous ridges.

Remarks. A peculiarity of this species is the extremely short terminal articulation of the branchlet. This articulation has nearly the same length as the surrounding bract-cells giving the termination of the branchlets a crowny appearance; hence the synonymic name *coronata*.

Concerning this species there are some nomenclatural questions demanding a solution now. GROVES & BULLOCK WEBSTER (1924, p. 14) already pointed out that GMELIN's name "*Braunii*" has to be used for the species as it has date priority over the name "*coronata*" of BRAUN

himself. The same is the case with some names of varieties and forms published by BRAUN. It will be seen below that the frequently used varietal name *leptosperma* A. BRAUN is invalid and must make way for MEYEN's name "*oahuensis*". Below, these matters are discussed in extension for the forms.

The following table gives a survey of the varieties known at present, together with their principal characters.

TABLE XIII.

Characters / Varieties of *C. Braunii* GMEL.	Length of oospore in μ	Number of ridges	Length of ant. bract-cells with respect to length oogon.	Situation of bract-cells	Shape of coronula cells
Braunii (A. BR.) ZANEV.	420—550	9	equal or shorter	unilateral or verticillate	short, obtuse
Schweinitzii (A. BR.) ZANEV.	550—650	9	longer	verticillate	short, obtuse
Kurzii ZANEV.	650—700	9	longer	verticillate	short, obtuse
Perrottetii (A. BR.) ZANEV.	600—650	9—10	equal	unilateral	short, obtuse
coromandelina (A. BR.) ZANEV.	500—550	7—8	equal	verticillate	short, obtuse
oahuensis (MEYEN) ZANEV.	600—750	10—12	equal or shorter	verticillate	elongate

Chara Braunii is a cosmopolitan species and therefore we may expect a good number of varieties and forms influenced by the different conditions of the environment. However, as T. F. ALLEN (1888, p. 359) already states, it is an interesting fact that the plant in any given locality is constant in its characters, and "though thousands of plants be examined they will all be found to exhibit precisely the same character". This is clearly shown in the form *javanica* occurring on the Dijèng plateau and first collected by JUNGHUHN c. 1840 and again by FEUERHORN in 1929. Both plants are quite identic in spite

of the long lapse of time. Therefore the discrimination of the more remarkably constant varieties and forms is very correct. And if we make use of the classification of T. F. ALLEN (1888, p. 361) who emphasizes the dimensions of the oospores and of the bract-cells, we cannot reject the earlier published names, but we have to bring them into accordance with his really good survey though it is only useful if one disposes of fertile plants with ripe oospores. Therefore I have added below to the description of each form a diagnosis in terms of ALLEN's classification. A definite subdivision of the species into varieties and forms can only be given by a monographer who has examined all the material.

The fact that *C. Braunii, C. pashanii* and *C. nuda,* in contradistinction to the likewise monoecious *C. corallina,* have no gametangia at the base of the branchlet-whorls is noteworthy, as it is a remarkable point of discrimination between these species and *C. corallina.* From *C. pashanii* and *C. nuda* it is mainly distinguished in having a corona-like termination to the branchlets and fairly well-developed stipulodes.

Ecology. *C. Braunii* is a medium-sized plant, often tufted in growth and very glossy (f. *javanica*). The clear green ecorticate stems and branchlets give it a *Nitella*-like appearance. Incrustation is but seldom present and then annular in character.

The species is distributed in all the continents and therefore much variable in habit. In the warmer regions it is restricted to mountainous areas: in the western Himalayas it occurs at an elevation of c. 1800 m, on Mt. Dijèng, Java, at an altitude of c. 1880 m, on Mt. Rindjani, Lombok, at 2000—2400 m.

C. Braunii is found in the stagnant water of ditches, lakes, large patches, etc., from November to May with ripe oospores. Especially the occurrence in the regions of solfataras is of interest. It is but seldom found growing mixed up with other *Charas* or phanerogamic aquatic plants. *Spirogyra setiformis* is often present between the branchlets.

The pH is only measured in Lake Toba, where it was 7.5.

Distribution. Between 65° N. and 35° S.; ASIA, India; Indo-China; Malaysia — AUSTRALIA, Hawaiian Islands; cf. varieties. Moreover in lit.: EUROPE, cf. MIGULA (1897, p. 331), GROVES & BULLOCK WEBSTER (1924, p. 13) — ASIA, Siberia, RUPRECHT (1845, p. 12); Japan, BRAUN & NORDSTEDT (1882, p. 113), MIGULA (1931, p. 215); China, BRAUN & NORDSTEDT (1882, p. 109); India:

Malabaria, DIXIT (1935, p. 258), Gangetic Plain, GROVES (1924, p. 372), ALLEN (1925, p. 599; 1928, p. 61; 1936, p. 51); Assam, Burma, GROVES (1924, p. 372); Malaysia: Philippine Islands, GROVES (1912, p. 70) — AMERICA, N. Am.: Canada, cf. var. *Braunii*; United States, BRAUN & NORDSTEDT (1882, pp. 110—112), ROBINSON (1906, p. 259); C. Am.: Mexico, cf. var. *Braunii*, St. Domingo, GROVES (1911, p. 38); S. Am.: Argentine, NORDSTEDT (1888, p. 188) — AFRICA, N. Afr.: Algeria, Senegambia, BRAUN (1868, p. 827); Egypt, cf. var. *Braunii*; Bogos Distr., BRAUN (1868, p. 827); S. Afr.: Cape Colony, NORDSTEDT (1889, p. 32); Mozambique, BRAUN (1868, p. 827) — AUSTRALIA, N. Austr.: Queensland, NORDSTEDT (1889, p. 32; 1891, no page), GROVES & ALLEN (1935, p. 55); S. Austr.: New South Wales, NORDSTEDT (1888, p. 188; 1889, p. 32); Victoria, NORDSTEDT (1889, p. 32; 1891, no page).

var. α **Braunii** (A. BRAUN) ZANEV., nov. comb. — *Chara coronata* ZIZ. var. *Braunii* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 296, *pro parte.*

Plant medium-sized. *Branchlets* 8—10 in a whorl, consisting of 4—5 articulations, the lower 3—4 elongated. *Bract-cells* unilateral or verticillate; posterior bract-cells always very short or rudimentary, anterior ones equal or shorter than the oogonium. *Bracteoles* resembling the anterior bract-cells, but frequently somewhat longer. ♂ and ♀ *gametangia* 1—3 together at the lowest two or three branchlet-nodes. *Oospores* 420—550 μ long, with 9 ridges. *Coronula* short and obtuse, up to 150 μ high.

Remarks. The typical variety of the species is characterized by the small oospore, the low number of ridges, and the small bract-cells, being shorter than the oogonium.

Distribution. Between 65° N. and 20° N.; ASIA, India, Malaysia, cf. formae. Moreover in lit.: EUROPE, cf. species — ASIA, Syria, cf. f. *typica* — AMERICA, Canada, United States, Mexico, cf. f. *typica* — AFRICA, Egypt, cf. f. *typica.*

f. 1. **typica** ZANEV., nov. form. — *Chara coronata* ZIZ. var. *Braunii* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 296; id., Consp. syst. Charac. europ., 1867, p. 4; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 108; T. F. ALLEN in Amer. Nat. 18, 1882, p. 358; MIGULA, Die Charac., 1897, p. 321 — *Chara coronata* ZIZ. ined., c. 1814; KUETZING, Spec. Alg., 1849, p. 520; A. BRAUN in COHN's Krypt. Fl. Schles. 1, 1876, p. 403 — *Chara Braunii* GMELIN, Fl. Bad. Alsat. 4, Suppl. 1826, p. 646; ROBINSON in Bull. New York Bot. Gard. 4, 1906, p. 258; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, p. 11 — *Chara coronata*

ZIZ. ssp. *Braunii* A. BRAUN in Ann. Sci. Nat. 2, 1834, p. 353; id. in Flora 18, 1835, p. 59; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 826, 1868 — *Charopsis Braunii* KUETZING, Phyc. Gen., 1843, p. 520; id., Phyc. germ., 1845, p. 257; HY in Bull. Soc. bot. France 60, Mém. 26, 1913, p. 25 — *Nitella Braunii* RABENHORST, Deutschl. Krypt. Flor. 2, 1847, p. 197.

Illustrations. GROVES in Journ. Bot. 22, 1884, pl. 242; MIGULA, Die Charac., 1897, figs. 81—82; id., Syn. Charac. europ., 1898, figs. 68—69; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, pl. 26.

Verticillorum ramuli 8(—10), 4—5 articulationibus earum 3—4 inferiores elongatae. *Bracteae* 3—4, unilaterales. ♂ et ♀ *gametangia* ad tries nodos inferiores. *Oosporae* 420—500 μ longae, plerumque geminatae valde trinae, 8—9 striatae.

Branchlets 8(—10), consisting of 4—5 articulations, the lower 3—4 elongated. *Bract-cells* 3—4, unilateral. ♂ and ♀ *gametangia* usually geminate, occasionally three together, at the lower three nodes. *Oospores* 420—500 μ long, with 8—9 ridges.

INDIA: W. Himalaya, Naini Tal, Kumaon, no date, STRACHEY & WINTERBOTTOM s.n., Himalayan herb. in herb. J. D. HOOKER (B), determination not certain.

Remarks. The Naini Tal plant is provisionally placed here as I did not see the type of forma *eremosperma* (RUPR.) ZANEV. (= f. *songarica* A. BR.) to which it probably belongs according to BRAUN (1882, p. 110). However, the number of striae is the same as in the var. *Perrottetii*, viz. 9—10, whereas the ripe oospores in the contrary are 420—475 μ long and 284—330 μ wide, also much shorter than is cited in the type description of *eremosperma*. Bract-cells verticillate though the posterior bract-cells are very short and the anterior ones are equal or shorter than the oogonia. Stipulodes 490—535 μ long, 117—135 μ wide. Oogonia geminate or triple. BRAUN has probably seen another specimen as he cites that the altitude is 6,500 feet. This note is not to be found on the label of the badly preserved fragments studied by me. The reason of the change of the name *songarica* is discussed under the forma *javanica*.

Distribution. Between 65° N. and 20° N.; ASIA, India: W. Himalaya. Moreover in lit.: EUROPE, cf. MIGULA (1897, pp. 331—332), GROVES & BULLOCK WEBSTER (1924, p. 13) — ASIA: Syria, BRAUN & NORDSTEDT (1882, p. 109) — AMERICA, N. Am.: Canada, North Carolina; C. Am.: Mexico, Missouri plains, BRAUN & NORDSTEDT

(1882, p. 110) — AFRICA, N. Afr.: Oase Dachel, BRAUN & NORDSTEDT (1882, p. 109).

f. 2. **sumatrensis** ZANEV., nov. form. — *Chara coronata* ZIZ., FILARSZKY in Arch. Hydrobiol. 1934, Suppl. Bd. 12, Trop. Binnengew. 4, p. 717.

Verticillorum ramuli 10, articulationes 4—5 (3—4 elongatae), c. 2 cm longae. *Bracteae* 3—4, verticillatae, 2 anteriores oogoniis aequilongae, 2—1 posteriores breviores. ♂ et ♀ *gametangia* solitaria ad nodos 2—3 inferiores. *Oosporae* 490—535 μ longae, 8—9 striatae.

Branchlets 10, consisting of 4—5 articulations of which 3—4 are elongated, c. 2 cm long. *Bract-cells* 3—4, verticillate, 2 anterior ones as long as the oogonia, 2—1 posterior ones shorter. ♂ and ♀ *gametangia* at the lower 2—3 branchlet-nodes, solitary. *Oospores* 490—535 μ long, with 8—9 ridges.

SUMATRA: East coast, Mt. Piso Piso, in a swamp, alt. 500 m, 28 II 1923, LÖRZING 9491 (Bz), *type*, cult. in the Bot. Garden Sibolangit; ibid., Bot. Garden Sibolangit, 24 IX 1923, LÖRZING 10165 (Bz), cult. from Mt. Piso-Piso material 9491; Tapanoeli, border of Lake Toba, spring-marsh, alt. c. 1250 m, in the valley of the A. Bong-Bong, 9 IV 1929, German Limnol. Sunda Exped. TBo3, TBo3c (Bu-Mus).

Remarks. This form has the usual small oospore with the number of striae peculiar to the var. *Braunii,* but in the situation of the bract-cells there is an interesting difference. Whereas in all described forms the bract-cells are unilaterally situated at the branchlet-nodes, they are verticillate in the present form. BRAUN states (1882, p. 110) that he American form *longifolia* has verticillate bract-cells only at the lowest branchlet-nodes, in the other ones, however, they are unilateral. It must be noted that in the Naini Tal plant the bract-cells are also verticillate, but that specimen has more ridges. In this form the coronula-cells are connate for the greater part, only the tops of the cells are strongly divergent. In the Mt. Piso-Piso material the coronula-cells have a height of 140 μ, and in the Toba specimens of 90 μ.

According to T. F. ALLEN (1888, p. 361) the form may be described as: forma *microcarpa, microptila, verticillata, subpachygyra, laxior.*

Ecology. The branchlets of the form *sumatrensis* show a distinct annular incrustation. The plants are overgrown with *Spirogyra setiformis* (ROTH) KUETZ. Other available data of the Toba specimens are: temperature 22°.3, pH 7.5, alkalinity $2.86 \cdot 10^{-4}$.

Distribution. 2° N.; ASIA, Malaysia: Sumatra.

var. β **Kurzii** ZANEV., nov. var. — *Chara coronata* ZIZ. var. *coromandelina* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 112, *pro parte.*

Planta major. *Caulis* ad 1000 μ diam. *Verticillorum ramuli* 9, articulationes 5—6 (4—5 elongatae). *Bracteae* 3, oogonium bis superantes, acutissimae. *Gametangia* solitaria ad nodos 2 inferiores. *Oosporae* 640—694 μ longae, 9 striatae. *Coronula* brevis, erecta.

Plant probably robust, brown-yellow-green, covered with clay. *Stem* diam. c. 1000 μ. *Branchlets* 9 in a whorl, c. 2 cm long, of 5—6 articulations of which 4—5 are elongated and the last one is equal in length to the surrounding bract-cells. *Stipulodes* c. 890 μ long and 220 μ wide. *Bract-cells* 3, all very much elongated, twice as long as the oogonia, already visible with the naked eye, 215—240 μ wide, ending in a sharp point, posterior bract-cell frequently somewhat shorter than the oogonium. *Bracteoles* similar to the anterior bract-cells. ♂ and ♀ *gametangia* solitary, but together at the two lowest nodes. Oogonia 712—757 μ long (excl. coronula), 472—498 μ wide; *spiral-cells* showing 9—10 convolutions; *coronula* c. 90 μ high, 150—178 μ wide at base, individual cells connate except the ultimate blunt tops; *oospores* black, 640—694 μ long, 392—435 μ wide with 9 narrow ridges.

INDIA: Gangetic Plain, Behar, no date, J. D. HOOKER s.n. (B), sterile specimen; Bengal, without exact locality, 1869, SULP KURZ 1925 (B), *type.*

Remarks. The outstanding features of this variety are the extraordinary length of the oospores together with the low number of ridges, and the large bract-cells being twice as long as the oogonia.

In contradistinction to BRAUN's remark (1882, p. 113), I found the oogonia never geminate. In T. F. ALLEN's terminology the plants are characterized as: forma *macrocarpa, macroptila, verticillata, subpachygyra, condensata.*

The Behar specimen bears the following remark by BRAUN: "*Ch. coronata* var. *coromandelina* (*Ch. involucrata* ROXB.)". As I pointed out under the var. *coromandelina* (cf. p. 145) it is my opinion too that *C. involucrata* is a synonym of the var. *coromandelina*; but the specimen on which BRAUN wrote this note belongs to the new var. *Kurzii.*

Distribution. Between 22° N. and 25° N.; ASIA, India.

var. γ **coromandelina** (A. BRAUN) ZANEV., nov. comb. — *Chara coronata* ZIZ. var. *orientalis* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 295, *pro parte* — *Chara coronata* ZIZ. var. *coromandelina* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 112, *pro parte* —

? *Chara involucrata* ROXBURGH, Fl. Indica, 3, 1832, p. 565; id. repr. 1874, p. 648.

Plant rather robust, brownish green, less *Nitella*-like than var. *Braunii*, up to 20 cm high, covered with clay. *Branchlets* ± 8 in a whorl, c. 1.5 cm long, consisting of 4—5 articulations of which 3—4 are elongated, the last one being as long as the surrounding bract-cells. *Bract-cells* 3, as long as the oogonia, anterior and posterior ones equally developed, 90—130 μ wide. *Bracteoles* usually somewhat longer than the oogonia. *Stipulodes* elongate, c. 800 μ long, c. 150 μ wide. ♂ and ♀ *gametangia* solitary and together at the two lowest nodes. *Oogonia* up to 625 μ long (excl. coronula), c. 418 μ wide; *spiral-cells* showing 8–9 convolutions; *coronula* c. 150 μ high, c. 222 μ wide at base, individual cells not spreading, egg-shaped with a blunt top; *oospores* black, 500—550 μ long, c. 356 μ wide with 7—8 thick prominent ridges.

INDIA: Coromandelia, Carnetic, Gengu, in a swamp, 1826—'28, BÉLANGER s.n., Herbier de l'Inde 94 (B), *type*; ibid., Bengal, without exact locality and date, KURZ 2752 (B).

INDO-CHINA: Tonkin, in a river between Lằng Dò and Cho Gidi, 12 X 1883, BON 2370 (P).

Remarks. The rather robust plant is characterized by a "large" oospore and a few number of ridges. However, I found the ripe oospores never longer than 550 μ, in contradistinction to T. F. ALLEN (1882, p. 358) who mentions 600—750 μ as the length. The size of the oospores have never been published, therefore I gave them above. BRAUN (1882, p. 112) cites the stipulodes as short, but they are as long as 800 μ. In the dried specimens the internodes are somewhat swollen, and contracted into the nodes.

According to T. F. ALLEN's terminology (1882, p. 361) the type may be described as: forma *meiocarpa, meioptila, verticillata, pachysperma, laxior.*

The different views with regard to the size are probably due to BRAUN, who mentiones in the "Fragmente" (1882, p. 113) three specimens, of which only two have the characteristics given in the type description (1849, p. 295). These two specimens are quoted above in the exsiccatae. The third specimen, however, KURZ 1925, does not belong to this variety, as it has much larger oospores with more ridges. This specimen is now described under the new variety *Kurzii.*

The description of var. *coromandelina* closely resembles that of *Chara involucrata* ROXBURGH (1832, p. 565; 1874, p. 648), however, as I did not see the original specimen the identity is not certain. If they

are synonyms, then var. *coromandelina* has to be named *involucrata* as that name has the priority.

The type specimen was mixed up with *Chara zeylanica*.

Distribution. Between 25° N. and 15° N.; ASIA, India; Indo-China.

var. δ **oahuensis** (MEYEN) ZANEV., nov. comb. — *Chara oahuensis* MEYEN, Reise um die Erde 2, 1835, p. 131, *pro parte* — *Chara coronata* ZIZ. var. *leptosperma* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 112; DE WILDEMAN, Prodr. Fl. Alg. Ind. Néerl., 1896, p. 96; id., Alg. Fl. Buitenz., 1900, p. 373.

Plant slender, elongate to compact, tufted; up to 20 cm high. *Stem* c. 800 μ in diam. *Internodes* ½—2 times the length of the branchlets. *Branchlets* 8—10 in a whorl, consisting of 4—6 articulations, the lower 3—4 elongate, 1.5—3 cm long, ultimate articulation short, hardly longer than the surrounding bract-cells; penultimate articulation sometimes also short. *Bract-cells* 3—4, unilateral or verticillate, very narrow, up to the same length as the oogonium. *Bracteoles* 2, slightly longer than the oogonium. ♂ and ♀ *gametangia* together at the lowest three nodes. *Coronula* very much elongated, 140—225 μ high; individual cells divergent, very wide and connate at base, above their middle abruptly narrowed, and ending into a blunt top. *Oospores* 600—750 μ long, with 11—12 ridges.

JAVA: Priangan, near Bandoeng, in lake Telaga Patengan, no date, JUNGHUHN s.n., ex herb. VAN DEN BOSCH (L), without ripe oospores, therefore identification uncertain; ibid., Poentjak, in a ditch at the road-side, c. 1350 m alt., 5 I 1894, VON SCHIFFNER s.n. (L), immature, therefore identification uncertain.

LOMBOK: E. Lombok, Rindjani mountains (N. side), no date, ELBERT 1192a (L), no ripe oospores, therefore uncertain; ibid., Rindjani Caldera, Poetih valley, 2000—2400 m alt., 6 V 1909, ELBERT 1193 (L), without ripe oospores, therefore uncertain.

Remarks. This variety can be divided into three more or less distinct forms. The above cited exsiccatae are not to be classified into one of these forms as they are immature.

Var. *oahuensis* was established by BRAUN in 1849, when he did not think it right to keep up MEYEN's *Chara oahuensis* as a distinct species and he therefore described it as a variety of *Chara coronata*. However, in 1882 BRAUN published a new variety *leptosperma* which was subdivided into three forms, one of these being *oahuensis*. This is in contradiction to the now adopted Nomenclatural Rules, reason why I have re-established the earliest published name. The type specimen is placed in the form *typica*.

Distribution. Between 21° N. and 8°.30′ S.; ASIA, Malaysia; Hawaiian Islands, cf. forms.

f. 1. **typica** ZANEV., nov. form. — *Chara oahuensis* MEYEN, Reise um die Erde 2, 1835, p. 131; KUETZING, Tab. Phyc. 7, 1857, p. 32; H. & J. GROVES in URBAN, Symb. Antill. 7, 1911, p. 38 — *Chara coronata* ZIZ. var. *oahuensis* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 296; T. F. ALLEN in Amer. Nat. 16, 1882, p. 361 — *Chara coronata* ZIZ. var. *Meyenii* A. BRAUN in Monatsber. Kön. Akad. Wiss. Berlin, f. 1867, p. 827, 1868 — *Chara coronata* ZIZ. var. *leptosperma* A. BRAUN f. *oahuensis* (MEYEN) A. BRAUN in Abh. Kön. Akad. Wiss. Berlin 1882, p. 113; NORDSTEDT, Australas. Charac. 1, 1891 (no page); LEMMERMANN in ENGLER's Bot. Jahrb. 34, 1905, p. 635; MACCAUGHEY in Bot. Gaz. 65, 1918, p. 136.

Illustrations. KUETZING, Tab. Phyc. 7, 1857, pl. 79, f. 2; NORDSTEDT, Australas. Charac. 1, 1891, pl. 7, figs. 7—8.

Planta tenuis, elongata, ad 18 cm alta. *Caulis* c. 800 μ diam. *Stipulodia* elongata, c. 445 μ longa. *Verticillorum ramuli* 8, 3 inferiores articulationes elongatae; segmenta ultima et penultima bracteis oogonioque circiter aequilonga. *Bracteae* 3—4, verticillati, anteriores circiter dimidio oogonii aequilongae, posteriores inchoatae, interdum brevissimae. *Bracteolae* 2, bracteis anterioribus aequales. *Coronula* elongata, c. 222 μ longa.

Plant slender, elongate, c. 18 cm high. *Stem* c. 800 μ in diam. *Stipulodes* long and slender, c. 445 μ. *Branchlets* usually 8 in a whorl, up to 1.5 cm long, the lower three articulations elongated; ultimate and penultimate articulations hardly longer than the surrounding bract-cells. *Bract-cells* 3—4, verticillate, anterior ones as long as or shorter than the oogonium, posterior ones much shorter or hardly developed. *Bracteoles* 2, similar to the anterior bract-cells. *Oogonia* 750—810 μ long (excl. coronula), 430—535 μ wide; *spiral-cells* showing 11—13 convolutions; *coronula* c. 222 μ high, 240 μ wide at base; *oospores* black, c. 667 μ long, c. 356 μ wide, with 11—12 inconspicuous ridges. *Antheridia* 400 μ in diam., earlier ripe than oogonia.

HAWAIIAN (SANDWICH) ISLANDS: Oahu, V 1831, MEYEN s.n. (B, *type*; L, cotype).

Remarks. As far as I am aware the exact dimensions of the type specimen have never been given; therefore I have cited them in the diagnosis of this form. F. *javanica* resembles much f. *typica*, but it is more compact, the stipulodes are c. 267 μ long, and the coronula shorter than 200 μ.

D i s t r i b u t i o n. 22° N.; Hawaiian Islands.

f. 2. **javanica** (A. BRAUN) ZANEV., nov. comb. — *Chara coronata* ZIZ. var. *Junghuhniana* A. BRAUN M. S. 1849, in herb. (B, K, L) — *Chara coronata* ZIZ. var. *orientalis* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 295, *pro parte* — *Chara coronata* ZIZ. var. *leptosperma* A. BR. f. *javanica* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 113; DE WILDEMAN, Prodr. Flor. Alg. Ind. Néerl., 1897, p. 30; id. Suppl. et Tabl. Stat., 1899, p. 96; id., Alg. Flor. Buitenzorg, 1900, p. 373; FILARSZKY in Arch. Hydrobiol. 1934, Suppl. Bd. 12, Trop. Binnengew. Bd. 4, p. 719.

I l l u s t r a t i o n s. FILARSZKY, Arch. Hydrobiol. 1934, Suppl. Bd. 12, Trop. Binnengew. Bd. 4, figs. 63—65; the pres. paper, figs. 16*a*—*d*.

Plants flexible, glossy, very much congested. *Branchlets* compact, incurved, up to 1.5 cm long with 3—4 elongated articulations. *Bract-cells* 3, verticillate, anterior cells shorter than the oogonium, posterior one very short, but seldom lacking. *Coronula* 133—222 μ high, individual cells for the greater part not contiguous, only connate in the lower parts, blunt at their tips.

JAVA: without exact locality and date, "No. 1 *Chara*", SPORLEDER s.n. (B), *type*; B a n j o e m a s, G. Dijèng, "In lacubus planitiei", 1880 m alt., III—IV, no year, JUNGHUHN s.n., ex herb. VAN DEN BOSCH in (L), two specimens with a subscription by JUNGHUHN: "*vulgaris*"; ibid., "ex aquis stagnantibus et lente fluentibus planitiei", alt. 1890 m, III—IV, no year, JUNGHUHN s.n. (B, K, L), in total 17 specimens with a note by BRAUN: "*Chara coronata* ZIZ. var. *Junghuhniana*"; ibid., "in aquis planitiei", 1880 m. alt, JUNGHUHN s.n. (B), ex herb. C. VAN DEN BOSCH 1858; ibid., Dijèng plateau, Kawah pool in a region of solfatara's, German Limnol. Sunda Exp. FD2, 3 VI 1929, FEUERHORN s.n. (Bu-Mus).

R e m a r k s. The outstanding features of this form are the compact habit and the glossy appearance. The stipulodes are less developed.

The type specimen consists of some fragments of fertile plants only. The *oogonia* are 756—845 μ long (excl. coronula), 500—540 μ wide showing 11—13 inconspicuous convolutions; *coronula* 150—180 μ high, 240—268 μ wide at base; *oospores* black, 680—740 μ long, c. 450 μ wide with 10 ridges. *Stipulodes* c. 267 μ long, 26—44 μ wide. *Antheridia* c. 356 μ in diam.

In following T. F. ALLEN (1882, p. 361)this form may be described as: forma *macrocarpa*, *microptila*, *verticillata*, *leiopyrena*, *clausa*.

BRAUN mentions in the "Fragmente" (1882, p. 113) "*Chara* No 1 SPORLEDER" as the type specimen of *C. coronata* var. *leptosperma* f. *javanica*. But the same specimen was already quoted by him (1849,

p. 296) as belonging to the var. *orientalis.* However, BRAUN cites in this last article *Chara eremosperma* RUPRECHT as a synonym of var. *orientalis.* The latter, on the other hand, is not mentioned at all in the "Fragmente", but there *C. eremosperma* is cited as a synonym of *Chara coronata* ZIZ. α *Braunii* A. BR. f. *songarica* A. BR. (1882, p. 109).

This leads me to the following conclusions:

1. the name of the var. *orientalis* is invalid and has to be named *eremosperma* (RUPRECHT) A. BRAUN;
2. the var. *orientalis* seems to comprise two different plants, *a.* one of these has later been described as forma *songarica* A. BRAUN, instead of which the name *eremosperma* (RUPRECHT) A. BR. has to be used, *b.* the other one is cited as belonging to *C. coronata* ZIZ. var. *leptosperma* A. BR. f. *javanica* A. BR., for which it is made clear above that it now must bear the name *C. Braunii* GMEL. var. *oahuensis* (MEYEN) ZANEV. f. *javanica* (A. BRAUN) ZANEV.
3. the var. *orientalis* A. BR. must be excluded.

Distribution. 7°30′ S.; ASIA, Malaysia: Java.

f. 3. **leptocoronulata** (FILARSZKY) ZANEV., nov. comb. — *Chara coronata* ZIZ. var. *pachysperma* A. BRAUN apud FILARSZKY f. *leptocoronulata* FILARSZKY in Arch. Hydrobiol. 1934, Suppl. Bd. 12, Trop. Binnengew. Bd. 4, pp. 718—719.

Illustrations. FILARSZKY, *l. c.*, figs. 58—62.

Plants more or less stiff, elongate, not at all glossy. *Branchlets* long, c. 3 cm, consisting of 4 elongated articulations. *Internodes* shorter than the branchlets, whorls close together. *Bract-cells* 3, verticillate, anterior ones as long as the oogonia or somewhat shorter, posterior one very short. *Coronula* 143—152 μ high, individual cells free, divergent.

JAVA: Priangan, Telaga Balèkambang, in a ditch, 5 VIII 1930, VAN STEENIS 4524 (Bz); Banjoemas, Dijèng plateau, spring basin on the left border of the G. Serajoe, alt. 2000 m, 5 VI 1929, German Limnol. Sunda Exped. D6ba (Bu-Mus), *type*, two specimens without ripe oospores.

Remarks. FILARSZKY established this form on the extremely long coronula-cells but his type specimen has no ripe oogonia, and moreover, in contradistinction to FILARSZKY's note on p. 719, the cells are shorter than those of f. *javanica.* Another characteristic of this form is the elongated stature in contradistinction to the compact habit of f. *javanica*, and in agreement with this the branchlets are twice as long. Therefore I did not unite this form with the preceding one.

According to T. F. ALLEN's terminology (1882, p. 361) this form might be described as: forma *macrocarpa, meioptila* vel *microptila, verticillata, leiopyrena, condensata.*

Ecology. To the Sunda specimen can be added: temp. 16.1° C., pH 6.7, alkalinity 0.48.

Distribution. 7° S.; ASIA, Malaysia: Java.

6. **Chara succincta** A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 114—115, pl. 7, figs. 200—202; T. F. ALLEN, Americ. Charac. 1, 1888, p. 54 (*nom. tant.*); NORDSTEDT in Lunds Univers. Års-skr. 25, 1889, p. 16 (*nom. tant.*); id. in Proc. Roy. Soc. Vict. 31, 1918, p. 5 (forma *novicaledonica* ined.); DIXIT in Journ. Ind. Bot. Soc. 10, 1931, p. 205, figs. 2—3.

Plant monoecious, entirely without cortex, flexible, transparent, bright-green, 10—15 cm high, not at all incrusted. *Stem* slender, c. 500 μ in diam. *Internodes* $^1/_3$—$^1/_2$ the length of the branchlets. *Stipulodes* in a single whorl, small, acute, as numerous as, and opposite the branchlets, sometimes rudimentary. *Branchlets* 7—8, composed of 5 articulations, of which the ultimate one is very short, acute, 2—4 cm long. *Bract-cells* 5—6 at the lower nodes, 3 at the ultimate one, anterior cells $^3/_4$ as long as the oogonium, posterior ones up to $^1/_4$ the length of the oogonium. *Bracteoles* similar to the posterior bract-cells. ♂ and ♀ *gametangia* not together at the base of the branchlet-whorls; clusters of oogonia only both inside and outside the base of the whorls. At the lowest branchlet-node mostly only the antheridia are found solitary or two together, however, sometimes one antheridium and one oogonium or two oogonia may be found together there. If the second branchlet-node is fertile, there are only antheridia extant. Antheridia c. 356 μ in diam. *Oogonia* c. 710 μ long (incl. coronula), c. 445 μ wide; *spiral-cells* showing 11—12 convolutions; *coronula* 100—108 μ high, c. 135 μ wide at base, individual cells compact, blunt; *oospores* dark chestnut-brown to almost black, c. 535 μ long, c. 312 μ wide, with 9—10 ridges.

NEW CALEDONIA: near Nouméa, VII 1896, BALANSA s.n. (P), *type* of *C. succincta* f. *novicaledonica* NORDST. ined.

Remarks. As BRAUN states in a letter to ASCHERSON (1878, p. 257), the species is different from *C. corallina* by the absence of antheridia at the base of the whorls; these are only extant at the lowest two branchlet-nodes. Other distinguishing characters are the smaller habit of the plant, and the smaller oogonia. *Chara pashanii* has no gametangia at the base of the whorls and no bract-cells at the ultimate branchlet-node.

The situation of the stipulodes is used in our key as a peculiarity of this species; in contradistinction to the hitherto mentioned ecorticate species they are opposite the branchlets and not alternating as NORDSTEDT already remarked (1882, p. 115), though he wrote on the same page "Stipulae alterniren mit den Blättern"! Probably the word "nicht" has been dropped.

DIXIT (1931, p. 207) noticed in his plant a number of stem-node bulbils in the month of January. BALANSA's plant collected in August does not show any trace of bulbils.

In one case I saw at the first branchlet-node an antheridium and an oogonium originating from the same cell, however, as is always the case in the genus

Lamprothamnium, the antheridium is situated above the oogonium. As too few ♂ and ♀ gametangia are preserved — and as, according to DIXIT, who had the opportunity to study fresh material, almost every part of this species even when found at the same place is variable — it requires more plants to ascertain if this is the normal position.

The various dimensions, and other characteristics of the above cited plants agree fairly well with the type description of BRAUN and as I have not seen the type itself, I have not cited the plant under the *nomen nudum* of NORDSTEDT, f. *novicaledonica*.

Ecology. All the year round in ponds with a high salinity. In the small island of Salsette, Bombay, it thrives in saline water having 2.5 % NaCl. It is mixed there with two *Spirogyra* species.

Distribution. Between 28° N. and 23° S.; NEW CALEDONIA. Moreover in lit.: ASIA, India: Isle of Salsette, DIXIT (1931, p. 205) — AFRICA: Libyan desert, BRAUN & NORDSTEDT (1882, p. 114); Mauritius, ex DIXIT (1931, p. 206).

7. Chara pashanii DIXIT in Journ. Ind. Bot. Soc. Bot. 14, 1935, p. 258.

Illustrations. DIXIT, *l.c.*, f. 1; the pres. paper, f. 11*a*.

Plant monoecious. *Stem* slender, c. 445 μ in diam. *Internodes* somewhat shorter than the branchlets. *Cortex* and *spine-cells* absent. *Stipulodes* opposite the branchlets, rudimentary. *Branchlets* 8—10 in a whorl, incurved, c. 2 cm long, S-shaped, composed of 3—5 articulations, the lower two frequently shorter than the following two, ultimate one c. 225 μ long, acute. *Bract-cells* 2—3, slender, usually reduced, lacking at the upper two nodes. *Bracteoles* 2, somewhat longer than the oogonia. ♂ and ♀ *gametangia* together at the two lowest nodes, not at the base of the whorls, usually two antheridia below 2—3 oogonia. *Antheridia* 198—225 μ in diam., earlier ripe than oogonia. *Oogonia* 620—700 μ long (incl. coronula), 460—480 μ wide; *spiral-cells* showing 8—10 convolutions; *coronula* 85—95 μ high, 170—180 μ wide at base; *oospores* black, 400—445 μ long, 267—289 μ wide with 6—7 ridges. *Bulbils* of the "strawberry type" at the lower stem-nodes, from which transparent rhizoids take rise.

INDIA: Malabaria, Pashan near Poona, in a ditch, XII 1930, DIXIT s.n. (L), duplicate of the *type*.

Remarks. DIXIT, in his article, emphasizes that *Chara pashanii* does not have any trace of even rudimentary stipulodes. The author was so kind as to send me some material, in which I could state, however, that rudimentary stipulodes were really present (cf. f. 11*a*). The plant has indeed so many characters of its own, that I share DIXIT's opinion in regarding it as new.

Chara pashanii is at once recognized by the wild tulip-shaped whorls of branchlets. It is nearly allied to *C. Braunii* but has no corona-like termination to the branchlets, whereas the stipulodes are always rudimentary and opposite the branchlets. The other resembling monoecious haplostephanous *Chara* species are *C. corallina*, which has the gametangia at the base of the whorls, *C. nuda*, which has solitary gametangia and *C. succincta*, which has oogonia at the base of the whorls, a fewer number of branchlets and well developed bract-cells, occurring at the ultimate node too.

Ecology. *C. pashanii* is much incrusted with lime. As an epiphyt is mentioned a species of *Zygnema*.

Distribution. 18° N.; ASIA, India: Malabaria.

8. Chara nuda PAL in Journ. Linn. Soc., Bot., 49, 1931, p. 81, pl. 15; id. in Journ. Burma. Res. Soc. 18, 3, 1929, p. 113 (*nom. tant.*).

Plant monoecious, entirely ecorticate, up to 15 cm high. *Stem* slender, 350 μ in diam. *Internodes* shorter than the branchlets. *Stipulodes* in a single whorl, usually rudimentary. *Branchlets* 7—8 in a whorl, composed of 5 articulations, without a corona-like termination. *Bract-cells* rudimentary. *Bracteoles* 0.5—1 times as long as the oogonium. ♂ and ♀ *gametangia* solitary at the two lowest branchlet-nodes, lacking at the base of the whorls. *Antheridium* 230 μ in diam. *Oogonia* 800 μ long, 525 μ wide; *spiral-cells* showing 14 convolutions; *coronula* 70 μ high, 190 μ wide at base, individual cells connivent; *oospores* black, 450 μ long, 330 μ wide, showing 12 inconspicuous ridges, ending in short basal claws.

Remarks. *Chara nuda* is closely allied to *C. Braunii* from which it can be distinguished by the rudimentary stipulodes, the solitary gametangia and the lack of a corona-like termination to the branchlets. From the other ecorticate monoecious *Haplostephanae C. corallina* and *C. fulgens* it is distinguished by having the gametangia at the branchlet-nodes only, whereas *C. pashanii* has aggregated gametangia. No specimens examined.

Ecology. The small plant is usually heavily incrusted with lime. It is collected in a swift flowing stream.

Distribution. 22° N.; ASIA: Burma.

II. Subsectio CORTICATAE A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 200; id., id., p. 296; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 799, 1868; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 18; T. F. ALLEN, Charac. America 1, 1888, p. 54; NORDSTEDT in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 5; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 55; ZANEVELD in Blumea 3, 1939, p. 380.

Cortical-cells on stem present, on branchlets absent or imperfectly present.

Key to the series.

1a. All branchlet-articulations ecorticate . . . . 1. GYMNOCLEMAE
b. Lowest branchlet-articulation ecorticate . . . . 2. GYMNOPODES

1. Series GYMNOCLEMAE ZANEV., nov. nom. — *Gymnophyllae* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 201; id., id., p. 296.

All articulations of the branchlets destitute of cortical-cells.

Remarks. The same reasons which GROVES led to the alteration of the names *Homocophyllae* and *Heterophyllae* into *Homoeoclemae* and *Heteroclemae* have influenced me to the alteration of BRAUN's name. This is in agreement with art. 62 of the International Rules of Botanical Nomenclature.

9. **Chara fibrosa** AG. ex BRUZELIUS, Observ. gen. Char., 1824; AGARDH, Syst. Alg., 1824, p. 129; BRUZELIUS & FÜRNROHR in Flora 9, 1826, p. 490; KUETZING, Spec. Alg., 1849, p. 521; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 53 — *Chara Benthamii*; *C. Curtissii*; *C. flaccida*; *C. flaccida* var. *brevibracteata*, var. *Gaudichaudii*, var. *oligarthra major*, var. *Wightii*; *C. gymnopitys*; *C. gymnopitys* var. *Benthamii*; *C. siboga*; cf. subspecies.

Plant monoecious, bright to brownish-green, flexible, 25—40 cm high. *Stem* moderately stout, 450—570 μ in diam. *Internodes* 1—4 times the length of the branchlets. *Stem-cortex* diplostichous, usually cells of the primary series more prominent than the secondary ones. *Spine-cells* single, acute, very variable in length, usually up to 165 μ long, however, a whorl of very long spine-cells (up to 1750 μ) pointing upwards is sometimes present just above each whorl of branchlets, whereas the upper spine-cells of a stem-internode are pointing downwards. *Stipulodes* forming a single whorl, well developed, elongated, acuminate, varying in number from as many as to twice as many as the number of branchlets, maximum length c. 2000 μ. *Branchlets* 8—16, consisting of 3—6 articulations, without cortex. *Bract-cells* 4—10, variable in length up to 4 times as long as the mature oogonia, acute at the apex. *Bracteoles* similar to the anterior bract-cells. ♂ and ♀ *gametangia* solitary or rarely geminate, together at the two or three lowest branchlet-nodes. *Antheridia* 300—450 μ in diam. *Oogonia* variable in length, up to 800 μ long, up to 555 μ wide; *spiral-cells* showing 8—11 convolutions; maximum height of *coronula* 100 μ, maximum breadth at base 180 μ; *oospores* golden-brown to black, 350—550 μ long, 275—400 μ wide, with 7 ridges.

Remarks. The present species was mentioned by BRAUN (1849, p. 297) as a synonym of *C. flaccida* var. *Gaudichaudii*. However, the name *C. fibrosa* has date priority.

Another interesting question is that of the delimitation of this highly variable species. As is pointed out below, I unite the three species *C. Benthamii* A. BR., *C. gymnopitys* A. BR. and *C. flaccida* A. BR. as subspecies into one large species for which the oldest name has to be accepted, i. e. *Chara fibrosa* AG. ex BRUZ. Most probably PAL's *Chara burmanica* belongs to this species in which case it has to be regarded as a subspecies too. As I have not seen a specimen I have to consider it provisionally as a separate species. It is distinguished by the entire absence of bract-cells and spine-cells, and the much longer oospores which are 700 μ long.

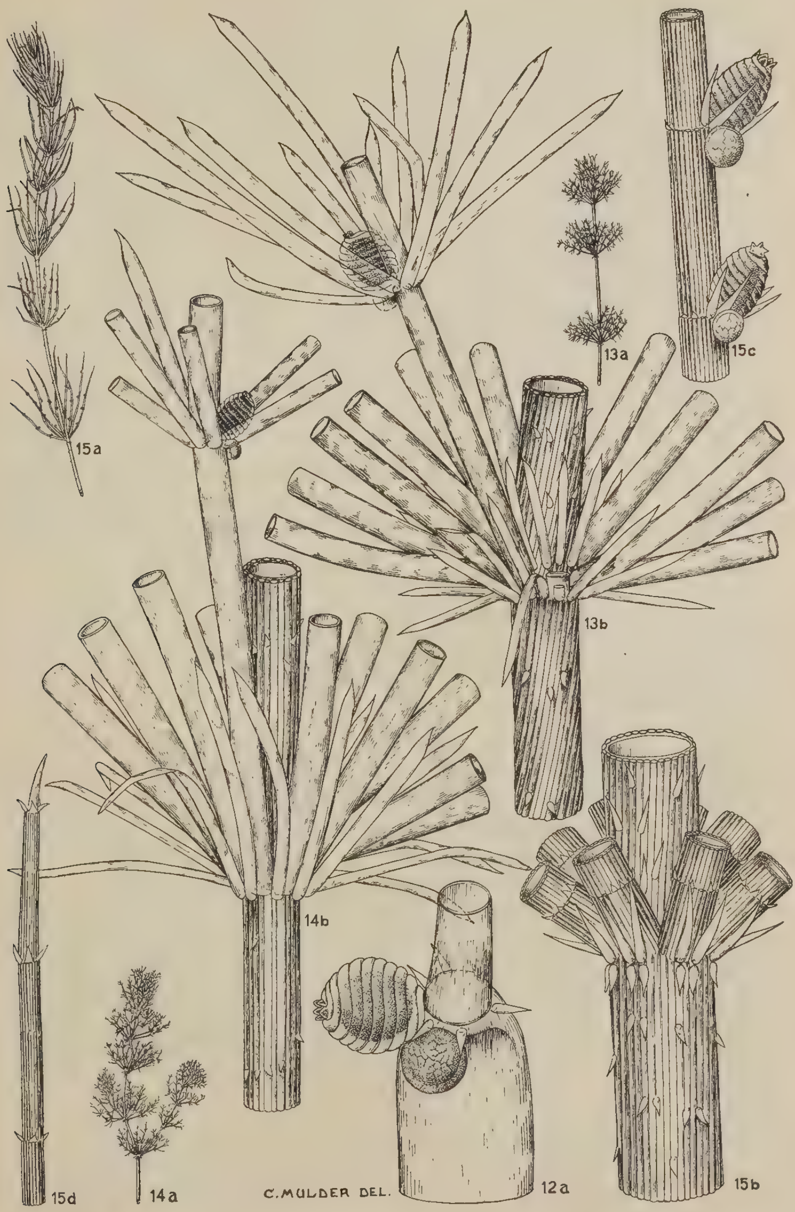
Another nearly allied species is *Chara erythrogyna* GRIFF. which differs by having the antheridia and oogonia produced at different branchlet-nodes. The same is the case with *C. psilopitys* A. BR., described from Australia and S. America (1882, p. 131). The only difference mentioned is the size of the stipulodes, which is very small.

The reasons why I unite the three species of BRAUN into a single one may be discussed now. *C. Benthamii* was established by BRAUN on account of the number of stipulodes being as numerous as the branchlets, whereas in *C. gymnopitys* and *C. flaccida* the number of stipulodes is twice as numerous as the branchlets. In studying the type of *Benthamii* from Hongkong it seems that this character is not constant, and the same is true for the number of stipulodes in the other species, as several authors already stated before. Therefore some authors followed BRAUN in describing specimens with 8—14 stipulodes as belonging to a separate species *C. Benthamii*, whereas others have described them as *C. gymnopitys* var. *Benthamii*.

JAMES GROVES, the late well-known authority on *Charophyta*, first followed BRAUN (1912, p. 70). Later on, when dealing with the Indian *Charophyta* (1924, p. 373), he treated *C. Benthamii* as a form or variety of *C. gymnopitys*, but again in his Madagascarian *Charophyta* (1927, p. 134) GROVES separated the two species. In his last paper written in collaboration with G. O. ALLEN (1937, p. 57), GROVES regarded once more the plants having one stipulode to each branchlet as a variety of *C. gymnopitys*.

With regard to the foregoing I examined very scrupulously the plants on this characteristic, and I found that a subdivision into two groups is possible. Into the ssp. *Benthamii* I insert the plants with 8—14 stipulodes, and those with more stipulodes and with a black oospore into ssp. *gymnopitys*. To this character of ssp. *Benthamii* but a few others are to be added. First of all the stipulodes are frequently longer and wider, and secondary the ripe oospores of ssp. *gymnopitys* are the largest, but the oogonia the smallest. In ssp. *gymnopitys* the number of striae is usually a little higher.

Fig. 12, *Chara corallina*; *a.* fertile branchlet-node, × c. 17 — Fig. 13, *Chara fibrosa*, plant intermediate between ssp. *Benthamii* and *gymnopitys*; *a.* habit, nat. size; *b.* stem-node with part of fertile branchlet, × c. 15 — Fig. 14, *Chara fibrosa* ssp. *gymnopitys* var. *typica*; *a.* habit, nat. size; *b.* stem-node with part of fertile branchlet, × c. 15 — Fig. 15, *Chara brachypus*; *a.* habit, nat. size; *b.* stem-node, × c. 18; *c.* fertile branchlet-nodes, × c. 20; *d.* apex of branchlet, × c. 20.


15a
13a
15c
13b
14b
15d
14a
C. MULDER DEL.
12a
15b

As to the main difference of ssp. *gymnopitys* and *flaccida*, I have to add that this is only to state with certainty on examining plants with ripe oospores. These are in the typical *flaccida* plants golden-brown and in *gymnopitys* black. But this character is also variable as I observed in the exsiccatae and as was already stated e.g. by GROVES in a plant from Ceylon (1921, p. 102) being "very dark brown". Other characters of minor importance are the oogonia being larger and more elongated, whereas they have a more roundish form in ssp. *gymnopitys*.

Finally there are also transitions between ssp. *Benthamii* and *flaccida* which is clearly shown in a plant from Tonkin in the Kew herbarium collected by BALANSA (No 16), to which J. GROVES adds on a label: "I should refer this to *C. flaccida* BRAUN on account of the golden-brown colour of the oospores, but it is distinctly uni-stipulate".

According to the above I consider the types of *Benthamii, gymnopitys*, and *flaccida* as the extremes of but one and the same widely distributed species *Chara fibrosa*, and I give them the rank of subspecies.

E c o l o g y. Cf. the subspecies.

D i s t r i b u t i o n. Between 50° N. and 50° S.; *C. fibrosa* is widely distributed in the tropical and subtropical regions of Asia, Africa and Australia, whereas the occurrence in America is not certain; cf. the subspecies.

subsp. A. **Benthamii** [1]) (A. BRAUN) ZANEV., nov. comb. — *C. Benthami* A. BRAUN in Monatsber. Kön. Akad. Wiss. Berl. f. 1867, p. 799, 1868 (*nom. tant.*), (non NORDSTEDT in Acta Univ. Lund. 16, 1880, p. 20); BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berl., 1882, pp. 18, 117; H. & J. GROVES in Philipp. Journ. Sci. 7, 1912, p. 70 — *Chara Benthamii* A. BR. ap. J. GROVES in Journ. Linn. Soc., Bot., 48, 1928, p. 134; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, p. 14; ZANEVELD in Blumea 3, 2, 1939, pp. 380—381 — *Chara gymnopitys* A. BR. var. *Benthamii* (A. BR.) J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 373; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 57.

I l l u s t r a t i o n s. BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pl. 7, f. 213; AGHARKAR & KUNDU, Journ. Dep. Sci. 1, 1937, pl. 7, f. 1—5; the pres. paper, figs. 19*a*—*b*.

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[1]) The orthography of the name "*Benthamii*" instead of "*Benthami*" is based upon the International Rules of Nomenclature, cf. also GROVES (1927, p. 134).

Plant monoecious, bright to greyish green, not incrusted at all, up to 40 cm high. *Stem* moderately stout, c. 570 μ in diam. *Internodes* 2–3 times the length of the branchlets. *Cortex* diplostichous, usually both series equally prominent though in many cases the primary series are more prominent. *Spine-cells* solitary, acute, up to 120 μ long, 45 μ wide. *Stipulodes* forming a single whorl, as numerous as the branchlets or 1—3 more, $^1/_2$—$^1/_3$ as long as the lowest branchlet-articulation, the largest stipulode being 1600 μ long, 150 μ wide, acute. *Branchlets* 8–12, consisting of 3—6 articulations, diminishing in length towards the apex, ecorticate. *Bract-cells* 6(—8) at fertile nodes, 4(—6) at sterile nodes, at the terminal articulation of the branchlets only 2(—4), twice to thrice as long as the oogonium, apiculate, the posterior ones less developed. *Bracteoles* similar to the bract-cells, however, frequently a little shorter. ♂ and ♀ *gametangia* solitary or rarely geminate at the two lowest nodes. *Antheridia* 350—415 μ in diam. *Oogonia* 700–800 μ long (incl. coronula), 460—550 μ wide; *spiral-cells* showing 8—11 convolutions; *coronula* 70—100 μ high, 140—180 μ wide at base, individual cells converging; *oospores* black, 420—540 μ long, 275—400 μ wide with 7—9 well defined ridges.

CHINA: H o n g K o n g, Little Hong Kong, in ditches, II 1858, WILFORD 238, herb. HOOKER in (B), together with *N. flagelliformis*.

MALAY PENINSULA: P a h a n g, Raub, gold mine, 13 IV 1924, BURKILL, St. of Pahang. 17474 (Si); ibid., Simpan River, XI 1924, BURKILL, St. of Pahang s.n. (Si); S i n g a p o r e, Singapore, lake in Botanic Gardens 1896, RIDLEY, Fl. of Singap. 6915 (Si); ibid., no date, RIDLEY s.n. (Si); ibid., 8 VII 1896, BLOW, Charophyta Blowiana 50 (K); ibid., 23 III 1908, no collector's name (K); ibid., VIII 1922, HOLTTUM, Fl. of Singap. 8389, (Si); ibid., 4 X 1929, NUR s.n. (Bz), sterile specimen; ibid., VII 1937, PESTAVA s.n. (L); ibid., Reservoir, 1906, RIDLEY, Fl. of Singap. 12567 (Si), immature, therefore not to be identified with certainty; ibid., Clumy Lake, XII 1922, HOLTTUM, Fl. of Singap. 10015 (Si).

JAVA: S e m a r a n g, marsh near Sf. Gernoe, Pegandan S. C. S., XII 1935, HEME s.n. (Bz), slender specimen without ripe oogonia.

PHILIPPINE ISLANDS: L u z o n, Prov. of Ilocos Norte, Burgos, 2 III 1917, RAMOS, Fl. of Philipp. 27248 (K, L), mixed with *Chara corallina* [1]).

KAI ISLANDS: Ohoitiel, near Toeal, 2 V 1922, JENSEN 306 (Bz, L).

NEW CALEDONIA: without exact locality and date, BALANSA 1553 (P).

R e m a r k s. The subspecies *Benthamii* is very nearly allied to ssp. *gymnopitys*, but differs by having one stipulode at the base of

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[1]) This specimen has a note by J. GROVES: "This seems to me to be referable to *C. Benthamii* BRAUN, though in some of the whorls the stipulodes are more numerous than the branchlets".

each branchlet. From ssp. *flaccida* it can be distinguished by the black ripe oospore.

BLOW's specimen no 50 has very long spine-cells, viz. as long as the diam. of the stem. Sometimes I saw two stipulodes between two branchlets of which only one was developed and the other rudimentary. In the Java specimen collected by HEME some oogonia have coronula cells which are globular in the lower parts.

E c o l o g y. In stagnant fresh water of lakes and ditches, and in marshes. The ssp. probably grows only in flat country. Most plants from the lake in the Singapore Botanic Gardens have a remarkable bright-green colour and very long internodes probably due to a high intensity of light.

The ssp. is only once found growing mixed up with *Chara corallina*. The seasonal distribution is from March to June and from October to January.

D i s t r i b u t i o n. Between 22° N. and 22° S.; ASIA, C h i n a; M a l a y s i a: Malay Peninsula, Java, Philippine Islands, Kai Islands — AUSTRALIA, New Caledonia. Moreover in lit.: ASIA: I n d i a, AGHARKAR & KUNDU (1937, p. 14) — AFRICA: M a d a g a s c a r, GROVES (1927, p. 134), ZANEVELD (1939, p. 381) — AUSTRALIA: Q u e e n s l a n d, GROVES & ALLEN (1935, p. 57).

subsp. B. **gymnopitys** (A. BRAUN) ZANEV., nov. comb. — *Chara gymnopitys* A. BRAUN in Linnaea 25, 1852, p. 708; id. in HOOKER's Flora Tasmanica 2, 1860, p. 159; id. in ZELLER in Journ. Asiat. Soc. Bengal 42, 1873, p. 193; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 18, 124; T. F. ALLEN, Charac. Americ. 1, 1888, p. 54 (*nom. tant.*); NORDSTEDT in Hedwigia 27, 1888, p. 190; id. in Lunds Univers. Årsskr. 25, 1889, p. 33; GUTWINSKI & NORDSTEDT in Bull. Int. Ac. Sci. Cracovie, Cl. Sc. Math. Nat. 1902, p. 578; NORDSTEDT in Proc. Roy. Soc. Victoria 31, 1918, p. 5 (*nom. tant.*); RIDLEY in Journ. Straits Branch R. A. Soc. 80, 1919, p. 164; J. GROVES in Journ. Linn. Soc., Bot., 46, 1922, p. 70; id. in Journ. Linn. Soc., Bot., 46, 1924, pp. 363, 373; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 599; J. GROVES in Journ. Linn. Soc., Bot., 48, 1927, p. 134; PAL in Journ. Burma Res. Soc. 18, 3, 1929, p. 113 (*nom. tant.*); id. in Journ. Linn. Soc., Bot., 49, 1932, pp. 65, 84; DIXIT in Journ. Ind. Bot. Soc. 14, 1935, p. 261; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1937, p. 56; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, p. 14; ZANEVELD in Blumea 3, 1939, pp. 380, 381.

I l l u s t r a t i o n s. KUETZING, Tab. Phyc. 7, 1857, pl. 50, f. 1;

BAILEY, Compreh. Catal. Queensl. Pl., 1909, pl. 690; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, pl. 7, figs. 6—9, pl. 8, f. 1.

Plant monoecious, brownish-green, covered with clay, up to 30 cm high. *Stem* rather stout, 450—520 μ in diam. *Internodes* 1—4 times the length of the branchlets. *Cortex* diplostichous, usually cells of the primary series more prominent than the secondary ones. *Spine-cells* single, acute, c. 165 μ long, c. 65 μ wide at base. *Stipulodes* forming a single whorl, as numerous as to twice as numerous as the branchlets, acute, c. 600 μ long, c. 75 μ wide, however, the maximum length is much greater, as AGHARKAR & KUNDU (1937, p. 15) measured a length of 2500 μ, and GROVES (1928, p. 135) of 3100 μ. *Branchlets* 9—16, consisting of 4—5(—6) articulations, ecorticate, strongly acuminate at the apex. *Bract-cells* 6—10, very long (in some plants of Madagascar they were 1200—1300 μ long, according to GROVES [1928, p. 135]), apex acute, posterior bract-cells on fertile nodes two times, anterior ones 3—4 times the length of the ripe oogonium, c. 150 μ wide. *Bracteoles* similar to the posterior bract-cells, 2—3 times as long as the oogonia, 150 μ wide. ♂ and ♀ *gametangia* produced at the three lowest nodes, solitary at the same nodes. *Antheridia* 300—400 μ in diam. *Oogonia* 510—720 μ long (incl. coronula), 385—500 μ wide; *spiral-cells* showing 9—11 convolutions; *coronula* c. 70 μ high, c. 160 μ wide at base, individual cells ovate, contiguous; *oospores* dark purple-brown to black, 330—650 μ long, 280—490 μ wide, with 9—11 ridges.

Remarks. The subspecies *gymnopitys* is the most variable of the three. It is subdivided by BRAUN (1882, pp. 18, 124—128) into four varieties of which the three last ones got a name, but the var. α was quoted without a name. It is doubtless that BRAUN hereby has meant the var. *typica*. This subdivision is mainly based on the length of the ripe oospores, though in this respect the sizes given on p. 18 of his paper are different from those cited in his descriptions on the pp. 124—128. All the plants studied by me belong to the typical variety, of which the ripe oospores have a length of 330—425 μ. A subdivision of the varieties seems not desirable just now.

BRAUN, in the type description (1852, p. 708), mentions the occurrence of a whorl of very long spine-cells just above the whorl of branchlets. This whorl was very well represented in a specimen from Borneo, MOTLEY 325, which I figured separately (cf. fig. 13*a*—*b*) as it is intermediate between ssp. *Benthamii* and *gymnopitys*.

As it is possible that one of the other varieties, hitherto only

recorded from Australia, may be found in our region. I give their principal characters in the following table.

TABLE XIV.

Characters / varieties of ssp. *gymnopitys*	Length of ripe oospore in μ	Number of ridges	Development of prim. and sec. cortical cell-series	Shape of spine-cells
typica (A. Br.) Zanev.	330—550	10—11	equal	short, acute
duriuscula (A. Br.) Zanev.	440—470	10	prim. more	papilliform
acanthopitys (A. Br.) Zanev.	700—720	9	id.	very long
trachypitys (A. Br.) Zanev.	680—720	11—12	id.	papilliform

T. F. Allen still distinguishes in Bull. Torrey Bot. Club 20 (1893, p. 20) another variety collected in U.S.A., viz. *keukensis*, which Robinson (1906, p. 273), and with good reason in my opinion, has regarded as a species, because the series of cortex-cells are thrice the number of the branchlets. Therefore the ssp. is not yet recorded from America.

The principal characters distinguishing this ssp. from the other two are the number of stipulodes agreeing with the number of branchlets and the black oospore.

Ecology. The ssp. *gymnopitys* is a prominent element in the rice-fields or paddies of the tropics and subtropics, sometimes forming a vegetable carpet, which according to Pal (1932, p. 51) may be aptly described as "forests" of *Chara* and *Nitella*. It sometimes occurs in running and sometimes in stagnant water of c. 35 cm depth, and never deeper which probably shows that this ssp. needs a high intensity of light. In this respect Pal's statement is of importance (1932, p. 54), which runs: "Plants of *N. acuminata*, *N. oligospira* and *C. gymnopitys* grown in glass-jars and placed at well-lighted window still suffered from lack of sufficient illumination, which was manifested by thin and lanky growth".

As is evident from the record in BRAUN & NORDSTEDT (1882, p. 126), the water may be a little brackish.

Though Malaysian plants have never been found in February and March, the species is probably present all the year round.

Distribution[1]). Between 40° N. and 50° S.; ASIA, Japan; India: Pegu; Indo-China; Malaysia: Malay Peninsula, Sumatra, Java, Borneo, Celebes, Timor, Philippine Islands, New Guinea — AUSTRALIA, Tasmania, cf. var. *typica*. Moreover in lit.: ASIA, China, GROVES (1924, p. 373); India: India Deserta, GROVES (1924, p. 373); Malabaria, DIXIT (1935, p. 61); Gangetic Plain, ALLEN (1925, p. 597); Bengal, AGHARKAR & KUNDU (1937, p. 15); Burma, PAL (1932, p. 34); New Guinea: Papua, NORDSTEDT (1889, p. 34); ? Marianne Islands, NORDSTEDT (1889, p. 8)[2]) — AFRICA, Madagascar, GROVES (1928, p. 134); ZANEVELD (1939, pp. 380, 382) — AUSTRALIA: Victoria, BRAUN & NORDSTEDT (1882, p. 126); Tasmania, New Zealand, BRAUN (1852, p. 708), BRAUN & NORDSTEDT (1882, pp. 124—128), NORDSTEDT (1888, p. 191).

var. α **typica** (A. BRAUN) ZANEV., nov. comb. — *Chara gymnopitys* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 124, *pro parte*; NORDSTEDT in Hedwigia 27, 1888, p. 190; id. in Lunds Univers. Års-skr. 25, 1889, p. 33 (f. *aequistriata*); id. in Forschungsreise S. M. S. "Gazelle" 4, 1889, p. 8 (f. *longibracteata*); DE WILDEMAN, Prodr. Flor. Alg. Ind. Néerl., 1897, p. 30; id., Suppl. et Tabl. Stat., 1899, p. 96; H. & J. GROVES in Philipp. Journ. Sci. 7, 1912, p. 70 — *Chara gymnopitys* A. BR. var. "*alpha*" A. BR., T. F. ALLEN, Charac. Americ. 1, 1888, p. 54 (*nom. tant.*); id. in Bull. Torrey Bot. Cl. 22, 1895, p. 70; id. in Charac. Japon. Exsicc. No 10.

Illustrations. The pres. paper, figs. 14*a*—*b*.

Primary and secondary *cortical cell-series* equally developed. *Spine-cells* short, acute. *Oogonia* 510—620 μ long (incl. coronula), 385—475 μ wide; *spiral-cells* showing 11—12 convolutions; *oospores* 330—550 μ long, 280—390 μ wide, with 10—11 ridges.

INDIA: Pegu, Arracan, Kolodyne valley, in rice-fields, X 1869, KURZ 1964 (B), a slender specimen with short stipulodes, c. 175 μ long, c. 60 μ wide.

INDO-CHINA: Tonkin, near Quang-yen, in the river, 5 IX 1885, BALANSA 18 (K, B), a specimen with very short stipulodes.

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[1]) Cf. note [1]) on p. 59.

[2]) In the remaining literature this locality is only mentioned for ssp. *flaccida*, therefore not certain for ssp. *gymnopitys*.

MALAY PENINSULA: Perak, Menglember near Ipoh, in streams and hollows holding water, among the old mine heaps between Menglember and Lakat, 12 XI 1917, BURKILL, St. of Perak 2794 (K, Si); Pahang, Telok Sisik, Kuantan, in a pool of brown peaty water, 4 XII 1924, BURKILL, St. of Pahang 17347a (Si); Negri Sembilan, Gemas, in pools, 9 VIII 1919, CHIPP, Fl. of Negri Sembilan 4981 (K, L, Si), three immature specimens, therefore determination not certain; Malacca, in a rice-field along the road to Batu Truja, VII 1889, RIDLEY s.n. (Si); Singapore, Bot. Gard. Lake, 1 XII 1896, RIDLEY, Fl. of Singapore 8089 (K, L), a plant with globose oogonia.

SUMATRA: Tapanoeli, Lake Toba, 9 I 1923, HEIDE s.n. (S.).

JAVA: Buitenzorg, Dèpok, 90 m alt., 25 VI 1922, BAKHUIZEN VAN DEN BRINK 5578 (Bz, L); ibid., Buitenzorg, V 1922, HEIDE s.n. (Bz, L), the plant has a remarkably transparent stem.

BORNEO: Sarawak, Kapit, Upper Rejang River, in a shallow pond, 1929, CLEMENS 21499 (B, Bz); ibid., without exact locality and date[1]), MOTLEY 329 (K).

PHILIPPINE ISLANDS: Sibuyan, Magellanes, Mt. Giting-Giting, Prov. of Capiz, IV 1910, ELMER, Bur. of Sci. 12382 (Bz, K, L).

NEW GUINEA: N. N. G., Alkmaar, New Guinea Exped., 23 VII 1907, LORENTZ 15 (L).

TASMANIA: without exact locality and date, F. VON MUELLER 24 (L).

Remarks. Variety *typica* is the most widely distributed one, the other three, cf. p. 160, being only recorded from Australia.

NORDSTEDT (1889, p. 8) writes, that ssp. *gymnopitys* is distributed "im östlichen Afrika, im Ostindien, Borneo, auf den Mariannen und Celebes". However, this is in accordance with the distribution of ssp. *flaccida* cited in the "Fragmente" (1882, p. 129), up to that time the only source from which the distribution of these subspecies could be drawn (cf. General Part, Chapt. I, § 2). I think it therefore most probable that NORDSTEDT has erroneously mentioned the distribution of ssp. *flaccida* under ssp. *gymnopitys*.

Distribution. Between 40° N. and 45° S.; ASIA, India: Pegu; Indo-China; Malaysia — AUSTRALIA, Tasmania. Moreover in lit.: ASIA, Japan, T. F. ALLEN (1895, p. 71); ?Marianne Islands, Celebes, Timor, NORDSTEDT (1889, p. 8) — AFRICA, N. Afr.: Socotra; S. Afr.: Cape Colony, GROVES (1924, p. 373) — AUSTRALIA: W. Australia, Carpentaria, Arnhem Land, Queensland, Victoria, NORDSTEDT (1888, pp. 190—191; 1889, pp. 33—35), BRAUN & NORDSTEDT (1882, p. 125); Tasmania, BRAUN (1852, p. 708; 1882, p. 124).

subsp. C. **flaccida** (A. BRAUN) ZANEV., nov. comb. — *Chara flaccida* A. BRAUN in HOOKER's Journ. Bot. 1. 1849, p. 296; WALLMAN in

[1]) MOTLEY collected there between 1854 and 1859.

Act. Soc. Linn. Bordeaux 21, 1856, p. 52; T. F. ALLEN, Charac. Americ. 1, 1888, p. 55 (*nom. tant.*); GUTWINSKI & NORDSTEDT in Bull. Int. Ac. Sci. Cracovie, Cl. Math. Nat., 1902, p. 578; HATE in Journ. Bombay Nat. Hist. Soc. 19, 1909, p. 763; H. & J. GROVES in Philipp. Journ. Sci. 7, 1912, p. 70; J. GROVES in Philipp. Journ. Sci. 19, 1921, p. 664; id. in Journ. Linn. Soc., Bot., 46, 1921, p. 102; id. in Journ. Linn. Soc., Bot., 46, 1924, pp. 363, 372; PAL in Journ. Burma Res. Soc. 18, 1929, p. 113; id. in Journ. Linn. Soc., Bot., 49, 1932, p. 84; MIGULA in Hedwigia 70, 1931, p. 215; MUKERJI in Proc. 21st Ind. Sci. Congr., Bombay, 1934, p. 295; DIXIT in Journ. Ind. Bot. Soc. 10, 1931, p. 205; id. in Journ. Ind. Bot. Soc. 14, 1935, p. 261; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, p. 15 — *Chara hydropitys* A. BR. var. *flaccida* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 297 — *Chara flaccida* A. BR. var. *Wightii* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 296; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 128 — *Chara flaccida* A. BR. var. *Gaudichaudii* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 297; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 128 — *Chara flaccida* A. BR. var. *brevibracteata* A. BRAUN in BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 129 — *Chara flaccida* A. BR. var. ? *oligarthra major* A. BRAUN in BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 129 — *Chara Curtissii* T. F. ALLEN in Robinson in Bull. New York Bot. Gard. 4, 1906, p. 272; T. F. ALLEN in Bull. Torrey Bot. Cl. 7, 1880, p. 107 — *Chara siboga* AGARDH in herb. SURINGAR (L).

Illustrations. T. F. ALLEN, Charac. Americ. 1, 1888, f. 50; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, pl. 8, f. 1; the pres. paper, figs. 17*a*—*c*.

Plant monoecious, brownish-green, heavily incrusted, up to 35 cm high. *Stem* moderately stout, c. 500 μ in diam. *Internodes* 1—3 times the length of the branchlets. *Cortex* diplostichous, cells of the primary series more prominent than the secondary ones. *Spine-cells* single, acute, projecting horizontally, c. 65 μ long, c. 45 μ wide at base, however, sometimes rudimentary. *Stipulodes* forming a single whorl, up to twice as numerous as the branchlets, elongate, acute, usually 420—670 μ long (sometimes much longer), 40—65 μ wide, projecting more or less horizontally. *Branchlets* 10—12, consisting of 4—6 articulations, ecorticate, slender. *Bract-cells* 4—5 at the lowest nodes, 3 at the apex, straight or slightly incurved; anterior pair 1—2 times the length of the ripe oogonium, posterior pair on the first and second node similar to the anterior pair, on the other nodes, however, half as long as the oogonium;

the 3 apical bract-cells are different in length. *Bracteoles* similar to the anterior bract-cells, c. 120 μ wide. ♂ and ♀ *gametangia* usually at the lowest three nodes, now and then lacking at the third, solitary or geminate at the same nodes. *Antheridia* 300—350 μ in diam. (AGHARKAR & KUNDU cite [1937, p. 16] 408—464 μ). *Oogonia* up to 725 μ long (incl. coronula), 470—555 μ wide; *spiral-cells* showing 9—12 convolutions; *coronula* c. 75 μ high, c. 180 μ wide at base, apices of the individual cells contiguous; *oospores* golden-brown, 420—550 μ long, 310—395 μ wide, with 8—11 ridges.

INDIA: Malabaria, Madras, no date, WIGHT 133, herb. HOOKER in (B), *type* of *C. flaccida* var. *Wightii*; Gangetic Plain, Saharanpore, 1845, LEHMANN s.n., herb. BOISSIER in (B); Bengal, without exact locality and date, KURZ 2753 (B), *type* of *C. flaccida* var. *brevibracteata*, mixed up with *Nitella oligospira* and *Chara brachypus*; ibid., 1871, KURZ 2754 (B); ibid., c. 1872, KURZ 2755 (B).

INDO-CHINA: Tonkin, Onombi, in pools with brackish water, 5 XI 1885, BALANSA 16 (K, L); ibid., Kiên Khê, in the river Dông Hâm, 19 XI 1883, BON 2306 (P), mixed with *Chara brachypus.*

MALAY PENINSULA: Kedah, Lake Dayong Bonting, IX 1890, CURTIS, Fl. of Kedah 2587 (Si), three specimens; Malacca, Ayer Kerdi, 1899 ?, RIDLEY s.n. (Si), badly preserved specimen.

SUMATRA: Tapanoeli, Lake Toba, Batak districts, 16 VII 1904, VAN DAALEN 539b (Bz, L), mixed up with *Chara australis* and *C. zeylanica.*

JAVA: Banjoemas, Noesa Kambangan, in a ditch on the way to Permisan, II 1931, BOEDIJN 987 (Bz), very fine annular incrusted and overgrown with green algae; Soerabaja, Soerabaja, desa Glagah, III 1935, Bodemk. Ambtenaar s.n. (Bz), badly preserved specimen; ibid., Bawéan, 7 V 1928, KARTA 52 (Bz, L), heavily incrusted and very fragile with a note: "ager-ager".

BORNEO: S. and E. Division, Labuan-plateau, in ditches, with fresh water, no date, MOTLEY 9, herb. HOOKER in (K); two sterile specimens, therefore determination uncertain [1]); ibid., without exact locality and date, MOTLEY 218, herb. HOOKER in (K).

CELEBES: without exact locality, in ditches between plantations of *Colocasia*, no date [2]), ZOLLINGER 3440 (K, L).

PHILIPPINE ISLANDS: Mindanao, Subprov. of Bukidnon, in the vicinity of Tancular, VII 1916, FÉNIX, Fl. of the Philipp. 26079 (K, L).

SOEMBA: without exact locality and date, TEIJSMANN 11179 (Bz).

Vernacular names: Ganggeng (Malay); Rong ("= Fucus"), a name probably used in Tonkin for all larger algae.

Use: According to a note on the Bawean specimen it is used as agar-agar, but this is probably a mistake, as agar-agar is yielded by *Rhodophyta.*

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[1]) This is the specimen cited in BRAUN & NORDSTEDT (1882, p. 129) as collected by "Mr BROTLEY".

[2]) ZOLLINGER collected there between 1842 and 1848.

R e m a r k s. The only constant character of ssp. *flaccida* in which it differs from ssp. *gymnopitys,* is the golden-brown colour of its ripe oospores. Other differences are to be found in the size of the oogonia which are larger in the case of *flaccida,* the oospores being more elongate, and the stipulodes larger and narrower.

When Braun described his new species *flaccida* (1849, p. 296) he subdivided it at once into two varieties, i. e. *Wightii* and *Gaudichaudii.* Moreover, he distinguished in the "Fragmente" (1882, p. 128) two other varieties, i. e. *brevibracteata* and "? *oligarthra major*". His subdivision is based on the situation of the gametangia: geminate or solitary, on the number of ridges and branchlet-articulations and on the length of the bract-cells.

However, as I was able to study Braun's specimens and a good number of other ones, I found so many plants with transitional characters that a subdivision is not possible. Surveying all the material I found it very uniform and at present no subdivision is needed.

Most probably the American *Chara Curtissii* T. F. Allen in Robinson (1906, p. 272) is a synonym of ssp. *flaccida,* but as I did not see a specimen, I cannot decide this with certainty. If this would be true, however, then the ssp. is also distributed in America. Robinson states that T. F. Allen's figure 50 (1888) represents *C. Curtissii,* but the terminal articulation is ecorticate in contradistinction to Robinson's description, where this author writes that the terminal cell is corticated.

E c o l o g y. Ssp. *flaccida* inhabits shallow fresh water pools, ditches, ponds, rice-fields, etc. In the lake Dayong Bonting (Malay Peninsula) the bottom must be a perfect cushion of this plant, as C. Curtis writes on the label: "By the use of a stone and piece of cord masses were brought up at every throw."

The ssp. is also recorded from low level muddy areas of Salsette (Dixit, 1931, p. 305) which are situated near the sea shore. Balansa records on the label of the Tonkin plant No 16 that it occurs in brackish water. These notes indicate that the ssp. is able to withstand a low salinity.

The periods in which it is found indicate that it is present during the whole year.

Inhabitants of the same locality are *Nitella oligospira, Chara australis, C. brachypus* and *C. zeylanica.*

D i s t r i b u t i o n. Between 40° N. and 10° S.; Asia, I n d i a:

Malabaria, Gangetic Plain, Bengal; Indo-China; Malaysia: Malay Peninsula; Sumatra; Java; Borneo; Celebes; Soemba; Philippine Islands. Moreover in lit.: Japan, MIGULA (1931, p. 215); India: W. Himalaya, MUKERJI (1934, p. 295); Malabaria, DIXIT (1931, p. 205; 1935, p. 261), Ceylon, GROVES (1921, p. 102), Coromandelia, GROVES (1924, p. 372), Burma, PAL (1932, p. 84); Marianne Islands, BRAUN (1849, p. 297) — ? AMERICA, Florida, T. F. ALLEN (1880, p. 107), ROBINSON (1906, p. 272), cf. remarks — AFRICA, Libyan Desert, BRAUN & NORDSTEDT (1882, p. 129).

10. **Chara erythrogyna** GRIFFITH, Not. Plant. Asiat. 2, 1849, p. 278; T. F. ALLEN, Charac. Americ. 1, 1888, p. 55 (*nom. tant.*); G. O. ALLEN in Journ. Ind., Bot., Soc. 7, 1928, p. 61; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 372 — *Chara Griffithii* A. BRAUN in BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 130; PAL in Journ. Burma Res. Soc. 18, 1929, p. 113 (*nom. tant.*); id. in Journ. Linn. Soc., Bot., 49, 1932, p. 65—82; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, p. 16 — *Chara erythrogona* GRIFFITH in J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 363; GROVES & ALLEN in Journ. Bot. 65, 1927, p. 339 — ? *Chara Thwaitesii* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 132.

Illustration. G. O. ALLEN, Journ. Ind. Bot. Soc. 7, 1928, pl. 6.

Plant monoecious, greyish green-brown, without incrustation, c. 25 cm high. *Stem* rather stout, 500—650 μ in diam., transparent. *Internodes* 1—3 times the length of the branchlets. *Cortex* diplostichous, cells of the primary series more prominent than those of the secondary ones. *Spine-cells* up to 1000 μ long (usually 600 μ), up to 36 μ wide at base, cone-like. *Stipulodes* in a single whorl, usually twice as numerous as the branchlets, elongate, with apiculate apices, c. 1600 μ long, c. 95 μ wide. *Branchlets* 13—16 in a whorl, c. 1.5—2 cm long, consisting of 6—8 articulations, ecorticate. *Bract-cells* 7—10, at the lower nodes usually 7—8, at the upper nodes 9—10, elongate, acute, up to 1000 μ long, 650 μ wide, anterior and posterior ones similar. *Bracteoles* twice the length of the oogonia. ♂ and ♀ *gametangia* disjuncted, produced at the 4—5 lowest branchlet-nodes, solitary or geminate. *Antheridia* usually at the two lowest nodes only, 250—360 μ in diam. *Oogonia* at the third and fourth branchlet-nodes only, c. 560 μ long (excl. coronula), c. 350 μ wide; *spiral-cells* showing 9—10 convolutions; *coronula* 40—45 μ high, c. 105 μ wide at base; *oospores* black, c. 400 μ long, c. 245 μ wide, with 8—9 ridges.

INDIA: "India orientalis", without exact locality and date, GRIFFITH s.n., herb. HOOKER in (B), *type* of *Chara Griffithii* A. BR.

Remarks. *Chara erythrogyna* is remarkable for the situation of the gametangia, being produced at different nodes of the branchlets, though the antheridia and oogonia are very seldom found together in the middle nodes. By this fact alone the species is distinguishable from the other haplostephanous diplostichous *Chara*'s with ecorticate branchlets, i. e. *C. fibrosa, C. burmanica,* and *C. psilopitys.*

As is already stated by several authors (G. O. ALLEN, 1928, p. 62; GROVES & ALLEN, 1927, p. 339) the present species is hardly separable from *C. Thwaitesii* A. BR. (1882, p. 132), which has the gametangia likewise disjuncted. The characteristics of the last-named species are the short stipulodes, and 10—12 branchlets composed of 4—5 articulations. However, these characters are extremely variable even in the same plant and it is therefore most probably to be regarded as a synonym of *C. erythrogyna,* though this can only be stated with certainty by experiments. As I did not see the type of *C. Thwaitesii,* I have not cited it as a synonym.

BRAUN states (1882, p. 130) that the specimen cited in our exsiccatae is identic with GRIFFITH's plant from Serampore, which was collected by HALOODAR and described as *C. erythrogyna.* However, BRAUN renamed the species as in his opinion the red colour of the oogonia is not a constant character, but changing during its lifetime and therefore not characteristic. This is in contradistinction to the now adopted International Rules. Moreover, the name was cited by him as "*erythrogona*".

J. GROVES (1924, p. 372) writes that *C. erythrogyna* occurs in Java and in Cochin-China. I could not find the original literature mentioning these localities, nor the exsiccatae. Therefore they are dubious.

Ecology. In a living state the antheridia are bright-red and the immature oogonia deep reddish brown, giving the plant a "very pleasant effect". It is found growing in roadside drains and in lakes, sometimes together with *Chara fibrosa* ssp. *gymnopitys.*

Plants with ripe oospores have been found in Burma from August to February.

Distribution: Between 30° N. and 8° S.; ASIA, India. Moreover in lit.: India: Gangetic Plain, BRAUN & NORDSTEDT (1882, p. 130), GROVES (1924, p. 372), GROVES & ALLEN (1927, p. 339); Bengal, GRIFFITH (1849, p. 279); Burma, PAL (1932, p. 82); ? Indo-China: Cochin-China, GROVES (1924, p. 372); ? Malaysia: Java, ex GROVES (1924, p. 372).

11. Chara burmanica PAL in Journ. Linn. Soc., Bot., 49, 1932, p. 83, pl. 16; id. in Journ. Burma Res. Soc. 18, p. 113 (*nom. tant.*).

Plant monoecious. *Stipulodes* in a single row, small, blunt. *Stem-cortex* diplostichous, primary and secondary cell-series equally developed. *Spine-cells* absent. *Branchlets* ecorticate, strongly incurved, consisting of 5 articulations. *Bract-cells* absent. *Bracteoles* ½ to 1½ times the length of the oogonia. ♂ and ♀ *gametangia* at the two lowest branchlet-nodes, solitary. *Oospores* black, 700 μ long, 450 μ wide with 11—12 ridges, terminating in short basal claws.

Remarks. The species is very closely allied to *Chara fibrosa*, and has probably to be regarded as a subspecies thereof. The short diagnosis given above is from the type description, as I did not see a specimen.

Ecology. In shallow drains and marshy land at an altitude of 900 m and more. The species is very brittle and whitish due to heavy incrustation. The seasonal distribution is from September to December.

It is found together with *Chara Grovesii*, *C. Handae*, and *C. brachypus*.

Distribution. 22° N.; ASIA, India: Burma.

2. Series GYMNOPODES A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 202; id., id., p. 297.

Lowest articulation of the branchlets always destitute of cortical-cells.

12. Chara hydropitys REICHENBACH *apud* MOESSLER, Gemeinn. Handb. d. Gewächsk., 3, ed. 3, 1834, p. 1670; A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 297; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 55; A. BRAUN in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 799, 1868 (*nom. tant.*); BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 19, 133; T. F. ALLEN, Charac. Americ. 1, 1888, p. 56 (*nom. tant.*); H. & J. GROVES in URBAN, Symb. Antill. 7, 1911, p. 39; NORDSTEDT in Proc. Roy. Soc. Vict., N. S. 31, 1918, p. 5 (*nom. tant.*); G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 597; J. GROVES in Journ. Linn. Soc., Bot., 48, 1927, p. 135; GROVES & ALLEN in Journ. Bot. 55, 1927, p. 339; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 62; ZANEVELD in Blumea 3, 1939, pp. 381, 382 — ? *Chara nudipes* WALLMAN in Kon. Vet. Akad. Handl. 40, 1854, p. 293 — ? *Chara longibracteata* SALZMANN (non KUETZING), Pl. venal. Brasil. 1830, No. 743.

Illustrations. T. F. ALLEN, Americ. Charac. 1, 1888, f. 51 (var. *majuscula*).

Plant monoecious, yellowish brown-green, heavily covered with clay, up to 19 cm high. *Stem* rather slender, c. 450 μ in diam. *Internodes* as long as or somewhat shorter than the branchlets. *Cortex* diplostichous, though in some plants triplostichous, the primary series

more prominent than the secondary one. *Spine-cells* small and few, solitary, up to 199 μ long, acute. *Stipulodes* forming a single whorl, twice as numerous as the branchlets, acute, c. 375 μ long, c. 75 μ wide (maximum resp. 980 μ and 200 μ). *Branchlets* 8—13, up to 12 mm long, consisting of 5—7 articulations, of which the lowest and two or three terminal ones are ecorticate (in some of the branchlets, however, the cortex is sometimes not present at all). *Bract-cells* 4—6, acute, variable in length, the anterior pair equal to twice the length of the ripe oogonium. *Bracteoles* similar to the bract-cells, 1—1½ times the length of the oogonium. ♂ and ♀ *gametangia* at the lowest 3—5 nodes, solitary, at the same nodes. *Antheridia* 210—450 μ in diam. *Oogonia* 350—750 μ long (incl. coronula), 280—500 μ wide; *spiral-cells* showing 11—14 convolutions; *coronula* 50—105 μ high, 100—140 μ wide at base; *oospores* black, 280—530 μ long, 220—380 μ wide, with 9—13 ridges.

Remarks. *Chara hydropitys* is a well distinguishable species, being the only one belonging to the *Haplostephanae* with the branchlets partially corticated. The always ecorticate first branchlet-articulation is also found in a member of the *Diplostephanae*, i.e. *C. zeylanica*, which, however, differs in many other respects.

The species has a wide distribution but it has not been recorded from Europe and Australia. The size of the ripe oospores is much greater in the Asiatic plants than in those from other regions.

BRAUN (1882, p. 133—137) distinguished six varieties, and though I did not see many specimens it may be useful to give a survey of their characters and synonyms taken from the type descriptions (table XV).

It follows from the table that some of the varieties can hardly be maintained as they are different only in the number of corticate articulations and we may expect that more intermediate plants will be found. This is, moreover, clearly demonstrated by ROBINSON (1906), who writes (on p. 274) that *C. mexicana* has two or three corticate branchlet-internodes; in his key, however, it is placed under "Leaves with one corticated internode". It has therefore to be placed between *C. Liebmannii* and *C. Robbinsii*, but then both species merge gradually into each other. I therefore agree with GROVES (1911, p. 39) in considering them as synonyms.

Ecology. This tender looking species with the partly corticate branchlets occurs in shallow water of "quickly drying" up road-side ponds and rice-fields. According to G. O. ALLEN (1928, p. 66) it is,

in Saharanpur, mainly growing by itself in small scattered, spreading clumps, but here and there mixed up with *Chara zeylanica*. Notes on

TABLE XV.

Characters / Varieties of *C. hydropitys* A. BR.	Number of branchlets per whorl	Length of oospore in μ	Number of corticate articulations	Literature and synonyms
indica A. BR.	9–13	280—350	3–4	cf. below
genuina A. BR.	9—13	360–400	1–3	BRAUN (1858, p. 359) BRAUN & NORDSTEDT (1882, p. 134) T. F. ALLEN (1888, p. 56)
perfecta A. BR	9–13	360–400	4	BRAUN & NORDSTEDT (1882, p. 133) T. F. ALLEN, (1888, p. 56) *C. Liebmannii* ROBINSON (1906, p. 274)
majuscula NORDST.	9 - 13	400–530	1—5	BRAUN & NORDSTEDT (1882, p. 134) *C. Robbinsii* HALSTED *p p.* (1879, p. 183) *C. hydropitys* v. *septentrionalis* NORDST. ex T. F. ALLEN (1888, p. 56) *C. hydropitys* v. *mexicana* T. F. ALLEN (1893, p. 120) *C. Schneckii* ROBINSON (1906, p. 271) *C. mexicana* ROBINSON (1906, p. 274)
africana A. BR.	8—9	330 380	1–2	BRAUN & NORDSTEDT (1882, p. 135) T. F. ALLEN (1888, p. 56)
brachypitys A. BR.	8–9	580–620	0–3	BRAUN & NORDSTEDT (1882, p. 136) T. F. ALLEN (1888, p. 56)

the labels give furthermore *Chara corallina, C. fibrosa* ssp. *gymnopitys, Nitella acuminata* and *N. bipartita* as inhabitants of the same localities.

PAL (1932, p. 51) remarks that *C. hydropitys* is restricted to flat country and this agrees very well with the field annotations.

Ripe oospores are found from June to March.

D i s t r i b u t i o n. Between 42° N. and 30° S.; ASIA, I n d i a: Ceylon; M a l a y s i a, cf. var. *indica.* Moreover in lit.: I n d i a: Gangetic Plain, GROVES & ALLEN (1927, p. 373), ALLEN (1928, p. 63), Coromandelia, ALLEN (1928, p. 63), Bengal, AGHARKAR & KUNDU (1937, p. 17) — AMERICA, N. A m.: United States, ROBINSON (1906, pp. 271, 276); C. A m.: Mexico, BRAUN & NORDSTEDT (1882, p. 133), T. F. ALLEN (1893, p. 120), ROBINSON (1906, p. 274); S. A m.: Surinam, BRAUN (1858, p. 359), BRAUN & NORDSTEDT (1882, p. 134); BRAZIL, BRAUN & NORDSTEDT (1882, p. 136) — AFRICA, N. A f r.: Egypt, BRAUN & NORDSTEDT (1882, p. 136).

var. α **indica** A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 297; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 19, 135; T. F. ALLEN, Charac. Americ. 1, 1888, p. 56 (*nom. tant.*) — *Chara hydropitys* REICHB. in J. GROVES in Journ. Linn. Soc., Bot., 46, 1922, p. 102; id. in Journ. Linn. Soc., Bot., 46, 1924, pp. 363, 373; PAL in Journ. Burma Res. Soc. 18, 3, 1929, p. 113 (*nom. tant.*); id. in Journ. Linn. Soc., Bot., 1932, pp. 65, 81; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, pp. 11, 16.

I l l u s t r a t i o n s. AGHARKAR & KUNDU, Journ. Dep. Sci., N. S. 1, 1937, pl. 8, f. 3.

Plant varying in height, usually more than 10 cm, however, in some plants not more than 5 cm. *Branchlets* 9—13 in a whorl, composed of 6—7 articulations of which the lowest and two or three of the uppermost ones are ecorticate, whereas in some whorls some of the branchlets are entirely destitute of a cortex. The lowest articulation is about half as long as the succeeding ones. The corticate articulations have the cortical-cells in a double series. *Spine-cells* usually very small or rudimentary. *Oospores* 280—350 μ long, 220—260 μ wide.

R e m a r k s. This variety can be subdivided into three more or less distinct forms, though intermediates occur. Its principal characters are: the small ripe oospore and the high number of branchlets. It is restricted to Asia only.

D i s t r i b u t i o n. Between 27° N. and 10° S.; ASIA, I n d i a; S i a m; M a l a y s i a; cf. formae. Moreover in lit.: I n d i a: Ceylon, BRAUN & NORDSTEDT (1882, p. 135), GROVES (1922, p. 102); Gangetic

Plain, GROVES (1924, p. 373), ALLEN (1925, p. 597), Burma, PAL (1932, p. 82).

f. 1. **major** A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 297.

Illustrations. The pres. paper, figs. 18*a*—*c*.

Plants 5—10 cm high, otherwise identic with the variety *indica*.

INDIA: Assam, without exact locality and date, JENKINS s.n., herb. HOOKER in (B), *type* of var. *indica* and of f. *major*; ibid., without exact locality and date, no collector's name, herb. HOOKER in (B), together with *Chara brachypus*.

SIAM: Pak Raw, inside channel, between two parts of Talé Sap (water brackish, 4—6 m), 25 I 1916, ANNANDALE 15 (Si), together with *Chara corallina* and *C. zeylanica*.

MALAY PENINSULA: Perak, N. of Grik, from a small pool in a little stream, 17 VI 1924, BURKILL 12417 (Si).

JAVA: Buitenzorg, Tegal Sapi, 240 m alt., in rice-fields, 27 VII 1922, BAKHUIZEN VAN DEN BRINK fil. 1512 (Bz, L), mixed up with *Chara fibrosa* ssp. *gymnopitys*.

MADOERA: E. N. E. of Sampang, 25 m alt., in rice-fields, 5 III 1915, BACKER 19781a (Bz).

SUMATRA: Palembang, Lake Ranau, alt. 560 m, in a rice-field at the south border, German Limnol. Sunda Exp. RSaβ, 27 I 1929, (Bu-Mus), two dried specimens both determined by FILARSZKY (1934, p. 706) as *Nitella bipartita* n.sp.. In a little bottle are fragments on formalin with the same annotation, however, these belong to *Nitella acuminata* and *N. bipartita*. The dried specimens are not mixed up.

PHILIPPINE ISLANDS: Luzon, Prov. of Rizal, X — XI 1916, RAMOS, Bur. of Sci. 26748 (Bz, K, L, Si).

Distribution. Between 27° N. and 10° S.; ASIA, India; Siam; Malaysia.

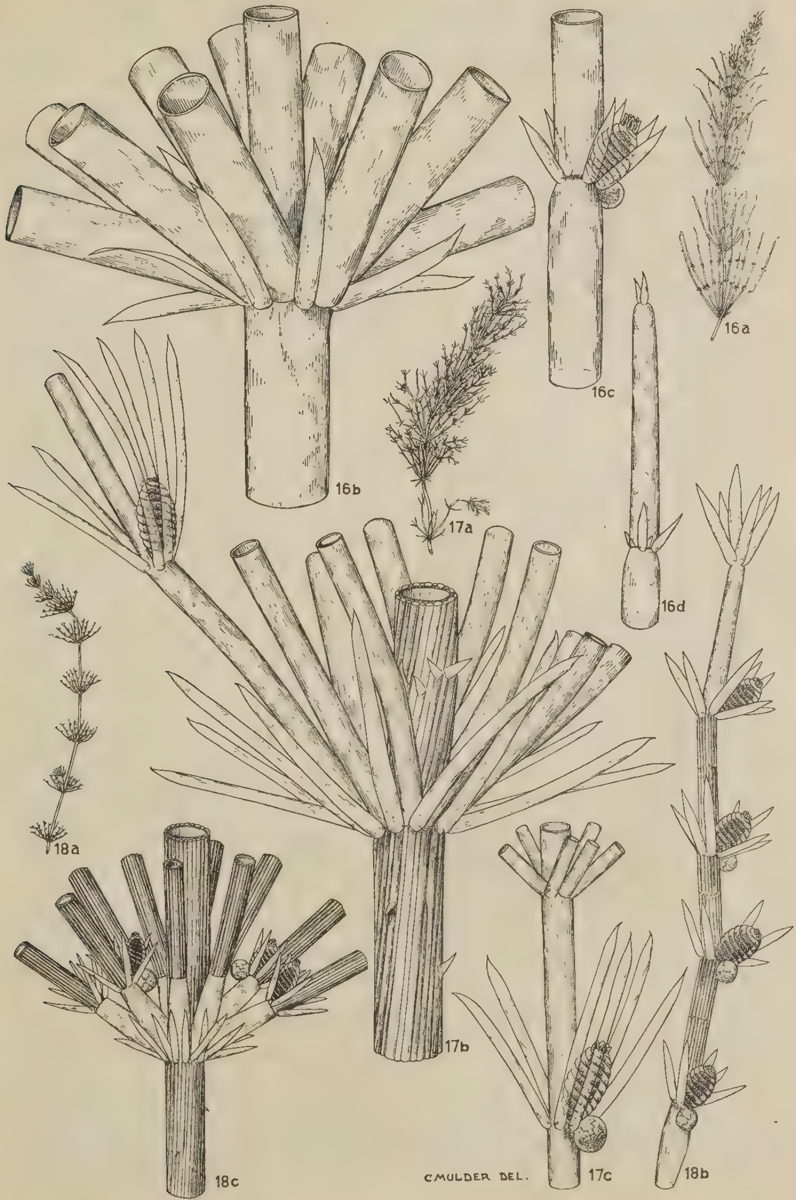
f. 2. **minor** A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 297 — *Chara chamaepitys* A. BRAUN in lit. and in herb. (B) — *Chara hydropitys* REICHENBACH var. *indica* A. BR. f. *pumila* A. BRAUN in herb. (B).

Plants up to 5 cm high, otherwise identic with the variety.

INDIA: Coromandelia, Coromandelian coast, 1826—1828, BÉLANGER 4 ♀ (B), *type*.

Remarks. Extremely small specimens which are at once distinguishable by their small habit.

Fig. 16, *Chara Braunii* var. *oahuensis* f. *javanica*; *a*. habit, nat. size; *b*. stem-node, × c. 15; *c*. fertile branchlet-node, × c. 15; *d*. apex of branchlet, × c. 18 — Fig. 17, *Chara fibrosa* ssp. *flaccida*; *a*. habit, nat. size; *b*. stem-node, × c. 20; *c*. part of fertile branchlet, × c. 22 — Fig. 18, *Chara hydropitys* f. *major*; *a*. habit, nat. size; *b*. fertile branchlet, × c. 10; *c*. stem-node, × c. 14 (the bract-cells on the branchlet-nodes in the middle of the figure are omitted).


16a
16b
16c
16d
17a
17b
17c
18a
18b
18c
C MULDER DEL.

Distribution. Between 10° N. and 25° N.; ASIA, Coromandelia.

f. 3. **gymnophylla** A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 297.

Plants similar to f. *major*, but most of the branchlets ecorticate. However, in the same specimens some of the whorls or some branchlets of a whorl are provided with a cortex.

INDIA: Bengal, Busna, VIII 1837, no collector's name, herb. HOOKER in (B), *type*; ibid., between Kissengunge and Titalya, in waters along the road, X 1868, KURZ s.n. (B).

Remarks. This form is remarkable as it forms a transition into *Chara fibrosa*, in which the branchlets are always partly corticate.

Distribution. C. 25° N.; ASIA: India: Bengal.

II. Sectio DIPLOSTEPHANAE A. BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10, 1849, p. 13; id. in HOOKER's Journ. Bot. 1, 1849, p. 203; id., id., p. 298; VON LEONHARDI in Verh. naturf. Ver. Brünn 2, 1864, repr. p. 41; A. BRAUN, Consp. syst. Charac. europ., 1867, p. 4; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 199, 1868; id. in COHN, Krypt. Fl. Schles. 1, 1876, p. 404; BRAUN & NORDSTEDT, in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 19; T. F. ALLEN, Charac. America 1, 1888, p. 57; H. & J. GROVES in URBAN, Symb. Antill. 7, 1911, p. 31; NORDSTEDT in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 5; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, p. 14; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 363; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 429; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 60; PAL in Journ. Linn. Soc., Bot., 49, 1932, p. 65; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 57; ZANEVELD in Blumea 3, 1939, p. 381 — *Chara* subgen. *Euchara* VON LEONHARDI in Lotos 13, 1863, repr. p. 14 — *Chara* sect. *Euchara* VON LEONHARDI in Verh. naturf. Ver. Brünn 2, 1864, repr. p. 41.

Stipulodes in a double whorl, frequently both rows well developed, however, sometimes one or both rows reduced.

Key to the subsections.

1a. Cortical cell-rows of the stem as numerous as the branchlets . . . . I. HAPLOSTICHAE

b. Cortical cell-rows of the stem twice as numerous as the branchlets . . . . II. DIPLOSTICHAE

c. Cortical cell-rows of the stem thrice as numerous as the branchlets . . . . III. TRIPLOSTICHAE

I. Subsectio HAPLOSTICHAE A. BRAUN, Consp. syst. Charac. europ., 1867, p. 4; id. in Monatsb. Kön. Akad. Wiss. Berlin f. 1867, p. 799, 1868; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 19; T. F. ALLEN, Charac. America 1, 1888, p. 58; HY in Bull. Soc. bot. France 60, 1913, Mém. 26, p. 28; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, p. 14; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 363; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 429; ZANEVELD in Blumea 3, 1939, p. 381 — *Chara* subsect. *corticatae isostichae* A. BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10, 1849, p. 13; id. in HOOKER's Journ. Bot. 1, 1849, p. 203; VON LEONHARDI in Verh. naturf. Ver. Brünn 2, 1864, p. 42; A. BRAUN in Krypt. Fl. Schles. 1, 1876, p. 404.

Rows of cortical-cells of the stem as numerous as the branchlets; rows of secondary cortical-cells lacking.

13. **Chara canescens** [1]) LOISELEUR, Not. Pl. aj. Fl. France, 1810, p. 139; ROBINSON in Bull. New York Bot. Gard. 4, 1906, p. 262; GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 373; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, p. 14, pl. 27 — *Chara crinita* WALLROTH, Ann. Bot., 1815, p. 190, pl. 3; BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1856, p. 338; KUETZING, Tab. Phyc. 7, 1857, p. 27, pl. 69, f. 1; BRAUN in Monatsb. Kön. Akad. Wiss. Berlin f. 1867, p. 829, 1868; T. F. ALLEN in Bull. Torrey Bot. Cl. 2, 1871, p. 10; HALSTED in Proc. Boston Soc. Nat. Hist. 20, 1879, p. 181; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 20, 137, pl. 7, figs. 221—222; T. F. ALLEN in Bull. Torrey Bot. Cl. 9, 1882, p. 40, pl. 18; id., Charac. America 1, 1888, p. 58 (*nom. tant.*); MIGULA, Die Charac., 1897, p. 348, figs. 87—90; HOLTZ in Mitt. Naturw. Ver. Neuvorpomm. u. Rügen 37, 1905, p. 41; PETKOFF, Charac. Bulgar., Rev. Ac. Bulgare Sci., 1914, p. 7; id. in Ann. Univ. Sofia, 1922, p. 1; ERNST in Zeitschr. ind. Abst. u. Vererb. Lehre 17, 1917, p. 203; id., ibid. 16, 1921, p. 144 and 25, 1921, p. 185; WINKLER, Verbr. u. Urs. d. Parthenog., 1920, p. 3; STROEDE, Oekol. d. Charac., 1931, p. 47.

Plant dioecious. *Stem* moderately stout, 800—900 μ in diam. *Internodes* 2—4 times the length of the branchlets. *Stem-cortex* haplostichous. *Spine-cells* very well developed, solitary or in clusters, frequently 2—5 together, 1—3 times as long as the diam. of the stem. *Stipulodes* in a double whorl, acuminate, cells of the upper whorl usually somewhat longer than those of the lower one. *Branchlets* 8—11 in a whorl, composed of 5—8 articulations, of which the upper one is ecorticate, the other ones haplostichous corticate. *Bract-cells* 5—6, slightly longer than the oogonium. *Bracteoles* similar to the bract-cells. *Bractlet*, taking the place of the antheridium, rudimentary. ♂ and ♀ *gametangia* solitary or

[1]) An extensive list of synonyms, not seen by the writer, figures and European literature are to be found in MIGULA (1897, p. 348) and in GROVES & BULLOCK WEBSTER (1924, p. 14).

geminate at the lowest 2—4 branchlet-nodes. *Antheridia* 560—700 μ in diam. *Oogonia* 550—850 μ long (excl. coronula), 360—550 μ wide; *spiral-cells* showing 13—15 convolutions; *coronula* 50—80 μ high, 100—150 μ wide at base, individual cells blunt; *oospores* black, 350—625 μ long, 225—400 μ wide, with 10—13, inconspicuous ridges, terminating in short basal claws.

Remarks. *Chara canescens* is mainly distributed in Europe, and is the only haplostichous member of the *Diplostephanae* in India. It is very remarkable for its parthenogenetic reproduction. According to MIGULA (1897, p. 357) male plants are only found in Romania, in France, in Greece, in the Caspian Sea, but the Greek record is doubtfull (cf. GROVES & BULLOCK WEBSTER, 1924, p. 17), and, according to PETKOFF (1914, 1922), in Bulgaria and to HOLTZ (1905, p. 43) in Hungary and Italy. In Sicily ♂ and ♀ plants have been found. This problem was first studied by BRAUN (1856) and was afterwards subject of extensive experiments by DE BARY (1871, 1875), WINKLER (1920), and ERNST (1917, 1921). No Indian specimens seen.

Ecology. The water in which *C. canescens* occurs is always brackish or saline. In Germany the minimum Cl-content is 1000 mg per liter, and the max. value is 19000 mg, i.e. in the Skagerrak, according to STROEDE (1931, p. 47). In Africa it is also found "in brakischem Wasser" (BRAUN, 1868, p. 830) and in America in slightly brackish water (ALLEN, 1882, p. 41), but, when an inlet was opened and the pond has become nearly as salt as the sea, the plant disappeared.

The species is mostly found on sand destitute of organic substances.

In Germany it grows often together with *Tolypella nidifica* and *Chara aspera*.

Distribution. Between 43° N. and 20° N.; EUROPE: cf. BRAUN & NORDSTEDT (1882, p. 138), MIGULA (1897, p. 359), GROVES & BULLOCK WEBSTER (1924, p. 16); ASIA: Arabia, BRAUN (1868, p. 830); the Urals, Afghanistan, Mongolia, China, BRAUN & NORDSTEDT (1882, p. 138); India: Baluchistan, BRAUN & NORDSTEDT (1882, p. 138), GROVES (1924, p. 373) — AFRICA, N. Afr.: Algeria, BRAUN (1868, p. 830); Egypt, BRAUN & NORDSTEDT (1882, p. 138) — AMERICA, N. Am.: Long Island, ALLEN (1871, p. 10; 1884, p. 40), BRAUN & NORDSTEDT (1882, p. 139); Massachusetts, ROBINSON (1906, p. 263).

II. Subsectio DIPLOSTICHAE A. BRAUN, Consp. syst. Charac. europ., 1867, p. 5; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 800, 1868; id. in COHN, Krypt. Fl. Schles. 1, 1876, p. 404; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 20; T. F. ALLEN, Charac. America 1, 1888, p. 58; HY in Bull. Soc. bot. France 60, 1913, Mém. 26, p. 29; NORDSTEDT in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 5; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, p. 18; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 363; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 429; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 57; ZANEVELD in Blumea 3, 1939, p. 381 — *Chara*-subsect. *Corticatae diplostichae* A. BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10, 1849, p. 13; id. in HOOKER's Journ. Bot. 1, 1849,

p. 203; id., id., p. 298; von Leonhardi in Verh. naturf. Ver. Brünn 2, 1864, p. 43.

Rows of cortical-cells of the stem twice as numerous as the branchlets; between two successive primary rows of cortical-cells one secondary row is produced.

Key to the series.

1a. Primary cortical-cells more prominent than the secondary ones, therefore spine-cells appear to be situated on ridges . . . . 1. Tylacanthae
b. Secondary cortical-cells more prominent than the primary ones, therefore spine-cells appear to be situated in furrows . . . . 2. Aulacanthae

1. Series Tylacanthae A. Braun in Cohn, Krypt. Fl. Schles. 1, 1876, p. 404 [1]); Braun & Nordstedt in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 20; T. F. Allen, Charac. America 1, 1888, p. 58; Hy in Bull. Soc. bot. France 60, 1913, Mém. 26, p. 28; Nordstedt in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 6; Groves & Bullock Webster, Brit. Charoph. 2, 1924, p. 33; J. Groves in Journ. Linn. Soc., Bot., 46, 1924, p. 363; Printz in Engler & Prantl, Nat. Pfl. fam. 3, ed. 2, 1927, p. 429.

Primary cells of the cortex more prominent and larger than the secondary ones, therefore spine-cells apparently situated on ridges.

14. Chara Grovesii Pal (non *N. Grovesii* Kundu) in Journ. Linn. Soc. Bot. 49, 1931, p. 85, pl. 17.

Plant monoecious. *Stem* moderately stout, 450—700 μ in diam. *Internodes* 1—5 times the length of the branchlets. *Stem-cortex* diplostichous, exhibiting strong torsion, cells of the primary series more prominent than the secondary ones. *Spine-cells* papilliform. *Stipulodes* in a double whorl, well developed, blunt and unequal in length. *Branchlets* 9—11 in a whorl, ecorticate, composed of 5—6 articulations. *Bract-cells* usually 5, the lateral ones often $^1/_3$ the length of the entire oogonium. *Bracteoles* longer than the oogonia. ♂ and ♀ *gametangia* together at the two lowest nodes, solitary. *Antheridium* 450 μ in diam. *Oogonia* 740 μ long (incl. coronula), 525 μ wide; *spiral-cells* showing 14—15 convolutions. *Ripe oospores* not yet collected.

Remarks. According to the author this species very much resembles *Chara contraria*, from which it can be distinguished only by its having entirely ecorticate branchlets. The mutual relations are therefore the same as for *C. vulgaris* and ssp. *squamosa*, and with reference to this *C. Grovesii* may be best regarded as a subspecies of *C. contraria*. As I did not see a specimen, I have not cited

[1]) In this article the name is spelt as "*tylacauthae*", which is most probably an orthographic error.

it in this way. The short description given above is from the type description.

Ecology. Very common in shallow drains, in streams and in pools. It emits a disagreeable odour. In its general habit it looks like a *Nitella*.

The seasonal distribution is from September to the end of November. PAL writes that it is entirely restricted to mountainous areas. It is found growing together with *Nitella superba*, *Chara burmanica*, *C. Handae* and *C. brachypus*.

Distribution. 22° N.; ASIA, India: Burma.

15. Chara contraria KUETZING[1]), Phyc. germ. 1845, p. 258; id., Spec. Alg. 1849, p. 523; BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10, 1849, p. 15; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 64; KUETZING, Tab. Phyc. 7, 1857, pl. 61 (the oogonia have but 3 coronula cells!); BRAUN, Consp. syst. Charac. europ. 1867, p. 6; id. in HOOKER, Handb. New Zealand Flor. 1867, p. 550; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 833, 1868; HALSTED, Classif. and Descr. Americ. spec. Charac., 1879, p. 187; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 20, 141; SYDOW, Bish. bek. Europ. Charac., 1882, p. 57; T. F. ALLEN, Americ. Charac. 1, 1888, p. 58 (*nom. tant.*); MIGULA, Die Charac., 1897, pp. 432, figs. 99—104; id., Syn. Charac. europ., 1898, p. 96, figs. 84—89; ROBINSON in Bull. New York Bot. Gard. 4, 1906, pp. 265, 266; SLUITER in Bot. Zeit. 68, 1910, p. 125, pl. 4, figs. 1—5 and text-figs. 1—9; NORDSTEDT in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 6 (*nom. tant.*); GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 363, 374; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, p. 36, pl. 33 (f. 9 is var. *hispidula*); G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 597; id. in Journ. Ind. Bot. Soc. 7, 1928, p. 64; STROEDE, Oekol. d. Charac. 1931, p. 42; G. O. ALLEN in Journ. Ind. Bot. Soc. 12, 1933, p. 17; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 57; FILARSZKY in Math. u. Naturw. Anz. Ungar. Ak. Wiss. 50, 1937, p. 484; VERDAM in Blumea 3, 1938, p. 16; HASSLOW in Bot. Not. Lund, 1939, pp. 296, 297, 298.

Plant monoecious, greyish-green, usually heavily incrusted, 20—30 cm high. *Stem* varying in diam., c. 750 μ. *Internodes* 2—4 times the length of the branchlets. *Stem-cortex* diplostichous, cells of the primary series more prominent than the secondary ones. *Spine-cells* solitary, obtuse, usually short and inconspicuous, however, in the var. *hispidula* once to twice as long as the diam. of the stem. *Stipulodes* in a double whorl, two pairs to each branchlet, usually short and sometimes almost spherical, irregular. *Branchlets* 6—10 in a whorl, consisting of 5—7 articulations, of which the upper 2—3 are ecorticate, the other ones diplostichous corticate, 0.5—3 cm long. *Bract-cells* usually 5, varying in length, the anterior pair equal or much longer than the oogonium, the lateral ones and the posterior cell mostly reduced to papillae. *Bracteoles* somewhat longer than the anterior bract-cells, 0.6—3 cm long. ♂ and ♀ *gametangia* solitary or rarely geminate (ROBINSON, 1906, p. 265), at the same 2—4 lowest nodes. *Antheridium* 300—450 μ in diam. *Oogonia* 650—1100 μ long (incl. coronula), 500—650 μ wide; *spiral-cells* showing 13—15 convolutions; *coronula* 120—190 μ high, 220—360 μ

[1]) Only the principal European literature is cited here; for a full list (incl. the varieties) I refer to MIGULA (1897, pp. 432—433), and GROVES & BULLOCK WEBSTER (1924, pp. 36—37).

wide at base, individual cells oblong, blunt at the apex, somewhat spreading; *oospores* black, 500—720 μ long, 350—490 μ wide, with 10—14 fine ridges, prolonged downwards into a cage; *outer membrane* yellow or golden-brown, granulate, with c. 6 granules per 10 μ.

CHINA: Kweichow, without exact locality, submerged in rice-fields and streams, 900 m alt., 5 VIII 1931, LIANG FEN YAH and TSUN YI HSIEN, Pl. of Kweichow 186 (L).

Remarks. The variability of this species, though less pronounced than in *C. vulgaris* has been a subject for many subdivisions. BRAUN's division into two varieties (1849, p. 16) i.e. *hispidula* with, and *moniliformis* without distinctly developed spine-cells, are found back in the arrangements of SYDOW (1882, pp. 57—58) and MIGULA (1897, p. 432). Some of the authors, however, regard these varieties as series. An extensive survey of the literature regarding this subject is to be found in Miss SLUITER's "Beiträge zur Kenntnis von *Chara contraria* A. BR. und *Chara dissoluta* A. BRAUN" (1910, p. 125).

GROVES & BULLOCK WEBSTER (1924, p. 36, 40) regard all plants with short and inconspicuous spine-cells as belonging to the species *C. contraria* proper, and they put all specimens with well developed spines together in the var. *hispidula*.

The present author shares BRAUN's first opinion, the plants mentioned in the exsiccatae therefore belong to the var. *moniliformis*.

Most probably the plants described as var. *australis* A. BR. and var. *Behriana* A. BR., both occurring in Australia belong also to the var. *moniliformis*, from which they can be distinguished by the larger oospore. Without having seen the types this cannot be decided with certainty.

Sometimes, *C. contraria* is hardly distinguishable from *C. vulgaris* though the typical specimens are characterized by the greater prominence of the primary cortical cell-series, so that the spine-cells are situated on ridges, by the much darker ripe oospores, and by the somewhat irregular stipulodes. It is a cosmopolitan species, but as yet it has not been collected in Malaysia.

Ecology. *Chara contraria* is a small to medium-sized plant, much incrusted with lime. According to STROEDE (1931, p. 43) it is in Germany only found in anorganotrophic waters of which the pH is c. 7.0. This water may be fresh or brackish, as the Cl-concentration may be rather high, varying from 25 to 3535 mg per liter. BRAUN & NORDSTEDT (1882, p. 142) record the plant from valleys in Songaria with a high percentage of salt.

Sandy bottoms are preferred by this species, and it occurs most frequently at a greater depth, c. 1—2 m, than *C. vulgaris*. Therefore, it is especially found in lakes and in larger water basins than the last named species. It is growing in the lowlands as well as in mountainous areas; in the Swiss Alps it is found at an elevation of 2000 m.

G. O. ALLEN (1928, p. 64) writes that in Saharanpur, *C. contraria* is a distinctly cold weather type; it does not seem to germinate before the middle of November, and disappeares at the end of April.

C. contraria, as *C. vulgaris*, commonly occurs in dense masses with little or no intermixture of other plants. However, in the vicinity *Chara tomentosa*, *C. aspera* and *C. globularis* are often to be found, and according to STROEDE, such

higher plants are present, as *Hypnum scorpioides*, *Potamogeton gramineus*, *Potamogeton Zizii*. In brackish water it grows together with *C. baltica*.

Distribution. Between 70° N. and 50° S.; ASIA, China. Moreover in lit.: EUROPE, cf. BRAUN & NORDSTEDT (1882, pp. 141—142); MIGULA (1887, pp. 441—442); GROVES & BULLOCK WEBSTER (1924, p. 38) — ASIA, Songaria, BRAUN & NORDSTEDT (1882, p. 142); India: W. and E. Himalaya, India Deserta, Malabaria, Burma, GROVES (1924, p. 374), Gangetic Plain, GROVES (1924, p. 374), ALLEN (1925, p. 597; 1928, p. 64; 1933, p. 17; 1936, p. 51) — AMERICA, N. Am.: Alaska, Quebec, ROBINSON (1906, p. 265); United States: Montana, Nebraska, Michigan, New York, Missouri, BRAUN & NORDSTEDT (1882, pp. 143—145), ROBINSON (1906, p. 296); Texas; C. Am.: Mexico, BRAUN & NORDSTEDT (1882, pp. 143—145); S. Am.: Bolivia, BRAUN & NORDSTEDT (1882, p. 145); Argentine, NORDSTEDT (1888, p. 191) — AFRICA, N. Afr.: Algeria, BRAUN (1868, p. 833); Egypt, BRAUN & NORDSTEDT (1882, p. 142); S. Afr.: Cape Colony, BRAUN (1868, p. 834) — AUSTRALIA, W. Austr.: ex GROVES & ALLEN (1935, p. 58); S. Austr.: BRAUN (1852, p. 709); NORDSTEDT (1882, p. 36); Kangaroo Islands, Queensland, GROVES & ALLEN (1935, p. 57); New South Wales, Victoria, NORDSTEDT (1889, p. 36); Tasmania, BRAUN & NORDSTEDT (1882, p. 143); New Zealand, BRAUN (1867, p. 550); BRAUN & NORDSTEDT (1882, p. 143).

2. Series AULACANTHAE A. BRAUN in COHN, Krypt. Fl. Schles. 1, 1876, p. 406; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 21; T. F. ALLEN, Charac. America 1, 1888, p. 59; HY in Bull. Soc. bot. France 60, 1913, Mém. 26, p. 28; NORDSTEDT in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 6; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, p. 18; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 363; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 429.

Secondary cells of the cortex more prominent and larger than the primary ones, therefore spine-cells apparently situated in furrows.

16. **Chara vulgaris** LINNAEUS, Spec. Plant., 1753, p. 1156, *pro parte* — *Chara foetida*; *C. foetida* ssp. *gymnophylla*; *C. gymnophylla*; *C. gymnophylla algeriensis*; *C. squamosa*; cf. subspecies.

Plant monoecious, greyish green, usually heavily incrusted, very much varying in length, usually c. 25 cm high. *Stem* moderately stout, c. 500 μ in diam. *Internodes* c. twice as long as the branchlets. *Cortex* diplostichous, cells of secondary series more prominent than the primary ones, which collapse in a dried state. *Spine-cells* single, much varying in length, frequently obtuse, if stout slightly spreading or appressed, if papilliform spreading, situated in furrows. *Stipulodes* in a double whorl, frequently cells of both whorls equally developed or those of the lower whorl somewhat depressed, short, obtuse, appressed. *Branchlets* (6—)8(—11) in a whorl, showing 6—8 articulations of which 3—5 are usually corticate (in the ssp. *squamosa* all ecorticate) frequently incurved, however, when fully mature recurved, varying in length. *Bract-cells* 4—6, obtuse or acuminate, extremely variable in length, usually unilateral, anterior ones much longer than the oogonium, posterior ones usually not developed at all, or as long as the

oogonium, in a few cases all bract-cells equally developed, usually lacking or papilliform at the ecorticate branchlet-articulations. *Bracteoles* similar or somewhat longer than the anterior bract-cells. ♂ and ♀ *gametangia* at the same 3—4 lowest nodes, usually solitary, rarely more together, lacking at the nodes above ecorticate articulations. *Antheridia* 275—540 μ in diam. *Oogonia* 525—800 μ long, (excl. coronula), 350—475 μ wide; *spiral-cells* showing 13—16 convolutions; *coronula* 75—125 μ high, 200—325 μ wide at base, individual cells blunt, more or less spreading; oospores golden-brown or dark-brown, rarely black, 425—675 μ long, 225—400 μ wide, with 12—15 ridges often prolonged into a cage; *outer membrane* tuberculate.

Remarks. *Chara vulgaris* is a cosmopolitan species and extremely variable in all parts, most probably due to conditions of growth. This variability was reason for a subdivision of the species. A number of subspecies and nearly related species were already cited by BRAUN & NORDSTEDT (1882) and by T. F. ALLEN (1888), whereas MIGULA (1897) and GROVES & BULLOCK WEBSTER (1924) regarded some of these again as varieties or forms. As I have not seen all the types of

TABLE XVI.

Characters / Subspecies of *C. vulgaris* L.[1]	Number of ridges	Shape of bract-cells	Diam. of antheridium in μ	Number of corticate articulat.	♂ and ♀ gametangia	Distribution
squamosa (A. BR.) ZANEV.	12–14	blunt	300–360	0	conjuncted	Eur. Asia Afr.
eu-vulgaris (A. BR.) ZANEV.	id.	id.	id.	2–4	id.	Cosm.
crassicaulis (A. BR.) ZANEV.	id.	id.	420—480	2—4	id.	Eur. Afr.
Rabenhorstii (A. BR.) ZANEV.	id.	id.	480—540	2—4	disjuncted	Eur.
Boveana (A. BR.) ZANEV.	10–11	acuminate	300—360	4—6	conjuncted	Eur. Asia Afr.
capensis (A. BR.) ZANEV.	9–10	id.	id.	3—7	id.	Afr.

[1]) Whether *C. Kokeilii* A. BR. must be placed here as a subspecies or in the *Triplostichae* as a separate species is as yet uncertain.

the different forms I cannot give a decision just now. However, from the type and other descriptions found in literature I provisionally get at the subjoined statement (table XVI).

Chara vulgaris closely resembles *C. contraria*, which is different by having the primary cortical-cells more prominent than the secondary ones, thus belonging to the tylacanthous type. If many spine-cells are present, this difference is very well visible in a transverse section of the stem, as the spine-cells in the case of *C. vulgaris* are then situated on the smaller cells. Another particular of the last species is that the "NORDSTEDT-markings", the decoration of the outer coloured ripe oospore membrane, consist of separate little tubercles, c. 7 per 10 μ, whereas in *C. contraria* they show contiguous granules, c. 6 per 10 μ. The ripe oospores are black in the last-named species while those of *C. vulgaris* are golden-brown to dark-brown (only in the var. *melanopyrena* black with a brown shade). It is somewhat surprising that typical representatives of the species were not extant at all amongst the material of the Netherlands Indies.

Ecology. *Chara vulgaris* is usually a medium-sized plant with a moderately stout stem. It is usually heavily incrusted with calcium carbonate, which is frequently not in annular bands. STROEDE (1931, p. 30) did not find the species in German waters with less than 55 mg CaO per liter.

The plant occurs in bogs, ditches, at the shallow margins of ponds and lakes, in very shallow running water of rivulets, and little streams. STROEDE has found it in Germany in anorganotrophic waters only. This author has also detected the species in a little brackish water containing c. 750 mg Cl per liter. The organic substances of the muddy bottom are always less than 50 %, whereas it contains a high amount of lime. Plants with ripe oospores are found in Saharanpur from November to May. In Germany ripe oospores were found from the late summer to autumn, according to STROEDE (1931, p. 29).

C. vulgaris occurs in lowland as well as in mountainous areas; it is recorded by BRAUN & NORDSTEDT (1882, p. 159) from 2300 m in the Swiss Alps and from 4500 m in the Cordilleras of Peru (*l.c.*, p. 166). It frequently grows in pure communities by itself, as the dense masses usually oust other species. *N. clavata* is the only species recorded to be found growing together with it.

Distribution. Between 70° N. and 50° S.; occurring in all the continents.

ssp. A. **eu-vulgaris** ZANEV., nov. ssp. — *Chara vulgaris* L.[1]), Spec. Plant., 1753, p. 1156, *pro parte*; WALLROTH, Annus Botanicus, 1815, p. 179, pl. 1; WILLDENOW in Mém. Acad. Roy. Berlin f. 1803, p. 84, 1805; BRUZELIUS & FUERNROHR in Flora 9, 1826, p. 486; AGHARD, Syst. Alg. 1824, p. 128; KUETZING, Phyc. Gen., 1843, p. 319, pl. 38, 39; id., Phyc. germ., 1845, p. 258; id., Spec. Alg., 1849, p. 523; id. Tab. Phyc. 7, 1857, pl. 58—60, 72, f. 2; ROBINSON in Bull. New York Bot. Gard. 4, 1906, pp. 255, 269; GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 363, 374; GROVES & BULLOCK WEBSTER, British Charoph. 2, 1924, p. 18, pl. 28, 29; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 63, pl. 2; STROEDE, Oekol. d. Charac. 1931, p. 29, pl. 2, f. 1; G. O. ALLEN in Journ. Ind.

[1]) A full list of European literature, other synonyms not examined by the writer, and illustrations are to be found in MIGULA (1897, pp. 554—556) and in GROVES & BULLOCK WEBSTER (1924, pp. 18—19).

Bot. Soc. 12, 1933, p. 17; ALLEN & HERTER in Revist. Sudamer. Bot. 1, 1934, p. 90; G. O. ALLEN in Journ. Ind. Bot. Soc. 15, 1936, p. 51; VERDAM in Blumea 3, 1938, p. 21; ZANEVELD in Blumea 3, 1939, pp. 381, 382 — *Chara foetida* A. BRAUN in Ann. Sci. Nat., Bot., 2, 1, 1834, p. 354; id. in Flora 18, 1835, p. 63; id. in HOOKER's Journ. Bot. 1, 1849, p. 298; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 63; BRAUN, Consp. syst. Charac. europ. 1867, p. 5; id. in HOOKER, Handb. New Zealand Fl., 1867, p. 550; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 838, 1868; HALSTED in Proc. Boston Soc. Nat. Hist. 19, 1879, p. 185; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 21, 159; T. F. ALLEN, Charac. Americ. 1, 1888, p. 59 (*nom. tant.*); NORDSTEDT in Hedwigia 70, 1888, pp. 191, 195; id. in Acta Univers. Lund. 25, 1889, p. 36; MIGULA, Die Charac., 1897, p. 554, figs. 121, 122, 124; id., Syn. Charac. europ. 1898, p. 122, figs. 106, 107, 109; NORDSTEDT in Proc. Roy. Soc. Victoria 31, N. S., 1918, p. 6 (*nom. tant.*); HASSLOW in Bot. Not. Lund, 1939, pp. 296, 299, 300.

Planta c. 25 cm alta. Caulis mediocriter robusta, 500 μ diam. *Internodia, cortex, stipulodia* et *bracteoli* eorum speciei similes. *Verticillorum ramuli* plerumque 8, articulis 6—8 quorum 2—4 ecorticatis. *Bracteae* plerumque 5, obtusae. ♂ et ♀ *gametangia* ad 4 nodos inferiores inserta, haud supra articulos ecorticata, plerumque solitaria vel 1—3 aggregata. *Antheridia* c. 360 μ diam. *Oogonia* 525—725 μ longa; oospora 425—520 μ longa, 12—14 striata.

Plant c. 24 cm high. *Stem* rather stout, c. 500 μ in diam. *Internodes, cortex, stipulodes* and *bracteoles* similar to those of the species. *Branchlets* usually 8 in a whorl, consisting of 6—8 articulations of which 2—4 are usually ecorticate. *Bract-cells* 5, obtuse. ♂ and ♀ *gametangia* together at the lowest 3 or 4 branchlet-nodes, however, not produced above ecorticate articulations. *Antheridia* c. 360 μ in diam. *Oogonia* 1—3 together, 525—725 μ long; *oospores* 425—520 μ long, with 12—14 ridges.

INDIA: W. Himalaya, Kumaon, Sariya valley, alt. 1650 m, no date, Himalayan herb., STRACHEY & WINTERBOTTOM s.n., ex herb. J. D. HOOKER in (B); Coromandelia, Jabalpur, in a brook, 1000 m alt., 21 XII 1875, KUNTZE 7282 (B), badly preserved specimen with unripe oogonia, therefore determination not certain; W. Bengal, Manbhoom, in rivulets, XII 1866, S. KURZ 1923 (B).

INDO-CHINA: Tonkin, W. Tonkin, without exact locality and date, BON 2854 (P).

Remarks. On account of its variability this subspecies is subdivided into a large number of forms. MIGULA distinguished in "Die Characeen" (1897) for Central Europe only, sixty-nine forms. The total number described nowadays is much higher than one hundred; the validity of these forms can only be proved by a separate study in which the experiment will be of great importance.

BRAUN (1868, pp. 839, 840) distinguished primarily two groups on account of the colour of the oospore, being brown or black (*Melanopyrenae*). The plants with a brown oospore were again subdivided into two series, viz.

Series I, *Subinermis*, in which the spine-cells are hardly visible even with a pocketlens, and

Series II, *Subhispida*, in which the spine-cells are usually as long as the diameter of the stem, thus visible with the naked eye.

This last series was given a subspecific rank by BRAUN in "Die Fragmente" (1882, p. 167), but as MIGULA (1897, p. 565) remarks, there are too few differences to share this opinion and it seems better to maintain BRAUN's first opinion.

MIGULA (1897, p. 565) has mainly taken over the first subdivision of BRAUN, but he unites the plants with less than two corticate branchlet-articulations and a brown oospore in a separate series, Series III, *Paragymnophyllae.*

The above cited exsiccatae have all a brown oospore and belong to BRAUN's series *subinermis.* They have well developed branchlets and bract-cells, which are 2—4 times as long as the oogonia. The number of branchlets and corticate articulations varies; the plants of KURZ and of STRACHEY & WINTERBOTTOM have 8 and 10 branchlets in a whorl respectively, whereas they have both 1—2 corticate articulations. The specimens of BON and KUNTZE have 8 and 11 branchlets respectively and also 3—4 corticate articulations. Regarding the specimen of KURZ 1923, BRAUN remarks that it possibly has been collected in Bengal. In the herb. of Berlin there were two specimens, one of which bears the note: "In rivulets of Manbhoom. W. Bengal", so that BRAUN's supposition has been right.

Ecology. Cf. the species.

Distribution. Between 70° N. and 50° S.; ASIA, India; Indo-China. Moreover in lit.: EUROPE — cf. BRAUN & NORDSTEDT (1882, pp. 159, 164, 167—170), MIGULA (1897, p. 550), GROVES & BULLOCK WEBSTER (1924, p. 20) — ASIA, Siberia, NORDSTEDT (1889, p. 36); Turkestan, HASSLOW (1939, p. 299); Songaria, Caucasus, Syria, Persia, Afghanistan, Tibet, Balutchistan, BRAUN & NORDSTEDT (1882, pp. 161, 166) — AMERICA, N. Am.: Canada, United States, C. Am.: Mexico, BRAUN & NORDSTEDT (1882, pp. 161—163), NORDSTEDT (1889, p. 37), ROBINSON (1906, p. 270); HASSLOW (1939, p. 300); S. Am.: Peru, Bolivia, Chili, Argentine, BRAUN & NORDSTEDT (1882, pp. 162, 164—166), Uruguay, ALLEN & HERTER (1934, p. 90) — AFRICA, N. Afr.: Tanger, Algeria, Egypt, Angola, BRAUN (1868, pp. 841—842); BRAUN & NORDSTEDT (1882, pp. 160, 161); S. Afr.: BRAUN (1868, p. 843), BRAUN & NORDSTEDT (1882, p. 160), NORDSTEDT (1888, p. 195); HASSLOW (1939, p. 300); Madeira, BRAUN (1868, p. 843); Madagascar, ZANEVELD (1939, pp. 381, 382) — AUSTRALIA; New Zealand, BRAUN (1867, p. 550), BRAUN & NORDSTEDT (1882, p. 162).

ssp. B. **squamosa** (DESFONTAINES) ZANEV., nov. comb.[1]) — *Chara squamosa* DESFONTAINES, Fl. Atlant. 2, 1800, p. 331; WILLDENOW in Mém. Acad. Roy. Berlin p. 1803, p. 88, 1805; id. in Spec. Plant. 4, 1805, p. 186; AGARDH, Syst. Alg., 1824, p. 127; BRAUN in Ann. Sci. Nat. Bot. 2, 1834, p. 354; id. in Flora 18, 1835, p. 61; KUETZING, Spec. Alg. 1849, p. 526; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 63; KUETZING, Tab. Phyc. 7, 1857, p. 29, pl. 72, f. 1 (var. *Fontanesiana*) — *Chara foetida* A. BR. ssp. *gymnophylla* A. BRAUN in Ann. Sci. Nat. Bot. 2, 1834, p. 354; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 834, 1868; id. in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 166, pl. 7, figs. 236—239; T. F. ALLEN, Charac. Americ. 1, 1888, p. 59 (*nom. tant.*); NORDSTEDT in Lunds Univers. Års-skr. 25, 1889, p. 37 — *Chara gymnophylla* A. BRAUN in Flora 18, 1835, p. 62; id. in N. Denkschr. Schweiz. Ges. d. Naturw. 10, 1849, p. 13; KUETZING, Spec. Alg., 1849, p. 520; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 63;

[1]) Cf. footnote on p. 182.

VON LEONHARDI, Die Oesterr. Arml. Gew., 1864, repr. p. 63; BRAUN, Consp. syst. Charac. europ., 1867, p. 5; MIGULA, Die Characeen, 1897, p. 543, f. 120; id., Synops. Charac. europ., 1898, p. 119, f. 105; GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 363, 374; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, p. 26; PAL in Journ. Linn. Soc., Bot., 49, 1932, p. 85; HASSLOW in Bot. Not. Lund, 1939, p. 299; DIXIT in Journ. Ind. Bot. Soc. 14, 1935, p. 260, f. 2 — *Chara gymnophylla algeriensis* KUETZING, Tab. Phyc. 7, 1857, p. 29, pl. 74, f. 2 [1]) (non KUETZING, pl. 51, f. 1).

Plant monoecious, greyish green, heavily incrusted, of variable height, c. 15 cm. *Stem* rather stout, c. 500 μ in diam. *Internodes, cortex, stipulodes* and *bracteoles* as described for the species. *Spine-cells* single, obtuse, frequently much shorter than the diam. of the stem, situated in grooves. *Branchlets* entirely ecorticate or rarely with one or two corticate articulations. *Bract-cells* blunt. ♂ and ♀ *gametangia* produced at nodes from which no cortex arises, solitary at the same nodes, or two or three (DIXIT — 1935, p. 261 — mentions 3—6) together with one or seldom two antheridia. *Antheridia* 300—400 μ in diam. *Oogonia* c. 800 μ long (excl. coronula), c. 450 μ wide; *spiral-cells* showing 13—14 convolutions; *coronula* c. 110 μ high, c. 200 μ wide at base. *Oospores* brown, 500—600 μ long, 300—350 μ wide, with 11—12 ridges.

INDIA: Malabaria, Bombay Pres., Nassik (= Nasik?) opposite the Westghats, 580 m alt., at the border of a river, 26 XII 1875, KUNTZE 7508 (B).

Remarks. The only characters serving to distinguish this ssp. from *eu-vulgaris* are the gametangia, being produced at nodes from which no cortical-cells arise, whereas the branchlets are frequently entirely ecorticate. The branchlets are more or less flexible owing to the lack of cortication; the branchlet-articulations are sometimes swollen and contracted into the nodes. In the above cited plant not so a high number of oogonia was extant as was noticed by DIXIT, though a max. number of three was not rare.

BRAUN (1868, pp. 835—836) subdivided this ssp. into 4 varieties, viz. α, β *Fontanesiana*, γ *patens*, δ *pachyphloea*, all being represented in Europe, Asia and Africa, the last three varieties differing in subordinate characters from the typical one. As a synonym of var. β *Fontanesiana* is cited *Chara squamosa* DESFONTAINES, already described in 1800 (Flor. Atlant. 2, p. 331). BRAUN writes that he first did not consider this plant a synonym as the type collected in Tunis had the cells of the coronula twice as long as var. α *typica*, the spine-cells well developed and the branchlets compact and incurved. These characters are very

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[1]) As BRAUN (1868, p. 834, note 1) already remarks, the *Chara* on this figure has two-celled internodes which are not known in the *Charophyta*. These can only be explained as cortical-cells originating from two whorls of initial cortical-cells belonging to the node at the base of each branchlet, one of which grows upwards and the other dwonwards, meeting each other at about the middle of an internode. This figure therefore cannot represent ssp. *squamosa*, but it is drawn after a *Chara* (possibly *C. vulgaris*) with a high number (5) of corticate branchlet-articulations and no ecorticate ones. Moreover, only the transverse cell-walls of the cortex are figured, and the longitudinal ones are not.

well figured in KUETZING's plate 72, fig. 1 (1857). Afterwards BRAUN saw more specimens, and then noticed more intermediate plants, and therefore decided to the identity of *C. squamosa* and *C. gymnophylla*. However, BRAUN does not use the older name *squamosa* as he considered it a misleading one; DESFONTAINES gave that name with reference to the spine-cells lying flat on the stem in dried plants which cause a scaly appearance. This is in contradiction with the nomenclature now adopted, reason why I have used the oldest name. Though I did not see the original plant of DESFONTAINES I examined some plants extant in the Leiden Herbarium which were determined by BRAUN himself as "*C. gymnophylla* β *Fontanesiana* (*C. squamosa*) DESF.". As these plants are quite identic with the *gymnophylla* plants I do not hesitate in considering them identic.

Ecology. In Algeria the ssp. is found in the inland waters, rivulets, swamps, as well as near the coast. In India it occurs in slowly running water. In Switzerland it is found at an elevation of 2500 m (Albula) and in the warm water of the "Leuker Bäder" in Wallis.

Characteristically it is a mediterranean plant; there it is collected with ripe oogonia from February to October. Another centre is Burma, where plants with ripe oogonia were collected in December and it mainly grows at an elevation of c. 1200 m.

Distribution. Between 50° N. and ?° S.; ASIA, India. Moreover in lit.: EUROPE — cf. BRAUN & NORDSTEDT (1882, p. 166), NORDSTEDT (1889, p. 21); MIGULA (1897, p. 550); ASIA, Caucasus, Syria, BRAUN & NORDSTEDT (1882, p. 166); Libanon, HASSLOW (1939, p. 299); China, ex GROVES (1924, p. 374); India: Bombay, DIXIT (1935, p. 261); Burma, GROVES (1924, p. 374). — AFRICA, N. Afr.: Algeria, BRAUN (1868, pp. 836, 837), NORDSTEDT (1889, p. 37), BRAUN & NORDSTEDT (1882, p. 167); Tunisia, Egypt, BRAUN (1868, pp. 836—837); S. Afr.: without exact locality, BRAUN (1868, p. 837).

III. Subsectio TRIPLOSTICHAE A. BRAUN, Consp. syst. Charac. europ., 1867, p. 6; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 800, 1868; id. in COHN, Krypt. Fl. Schles. 1, 1849, p. 408; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 22; T. F. ALLEN, Charac. America 1, 1888, p. 60; HY in Bull. Soc. bot. France 60, 1913, Mém. 26, p. 38; NORDSTEDT in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 6; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, p. 50; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 363; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 429; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 58; ZANEVELD in Blumea 3, 1939, p. 381 — *Chara* subsect. *Corticatae triplostichae* A. BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10, 1849, p. 19; id. in HOOKER's Journ. Bot. 1, 1849, p. 203; id., id., 298; VON LEONHARDI in Verh. naturf. Ver. Brünn 2, 1864, repr. p. 43 (*nom. tant.*).

Rows of cortical-cells of the stem thrice as numerous as the branchlets; between two successive primary rows two rows of secondary cells are produced.

Key to the series.

1a. All articulations of the branchlets ecorticate	1. GYMNOCLADIA
b. Lowest articulation of the branchlets corticate . . .	2. PHLOEOBASALIA
c. Lowest articulation of the branchlets ecorticate . . .	3. GYMNOBASALIA

1. Series GYMNOCLADIA ZANEV., nov. ser.

Ramulorum articulationes omnino ecorticatae.

All articulations of the branchlets destitute of cortical-cells.

Remarks. The species with this character are at present, as far as I know, only two in number, viz. *Chara Handae* and *C. guatemalensis*.

17. Chara Handae PAL in Journ. Linn. Soc. Bot. 49, 1932, p. 86, pl. 18.

Plant monoecious. *Stem* moderately stout. *Internodes* as long as or somewhat shorter than the branchlets. *Stem-cortex* triplostichous, cells of the primary series more prominent than those of the secondary one. *Spine-cells* well developed, solitary, acute, as long as the diam. of the stem. *Stipulodes* in a double whorl, acute, those of the upper whorl slightly better developed. *Branchlets* 9—11 in a whorl, incurved, composed of 5 ecorticate articulations. *Bract-cells* 4—8, well developed, except at the ultimate node, slender, acute. *Bracteoles* 1½ times the length of the oogonium. ♂ and ♀ *gametangia* together at the three lowest nodes, solitary. *Antheridia* 350 μ in diam. *Oogonia* 875 μ long (incl. coronula), 615 μ wide; *spiral-cells* showing 15—16 convolutions; *coronula* 105 μ high, 190 μ wide at base, individual cells straight; *oospores* black, 615 μ long, 400 μ wide, with 11—13 ridges, terminating in short basal claws.

Remarks. This species is distinguished from all hitherto known *Triplostichae* by the entirely ecorticate branchlets. As I did not see a specimen I gave an abstract from the type description.

Ecology. *Chara Handae* has a bushy appearance due to the short internodes and the long branchlets. PAL cites that it was found growing together with *Chara burmanica, C. Grovesii* and *C. brachypus.* The species was collected in a stream, and may be found from September to the middle of November.

Distribution. 22° N.; ASIA, India: Burma.

2. Series PHLOEOBASALIA ZANEV., nov. nom. — *Phloeopodes* [1]) A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 203; id., ibid., p. 298; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 800, 1868; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 22; T. F. ALLEN, Charac. America 1, 1888, p. 60; NORDSTEDT in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 6; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 374; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 429; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 58; ZANEVELD in Blumea 3, 1939, p. 381.

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[1]) Also spelt as "*Phlaeopodes*" by BRAUN.

Lowest articulation of the branchlets provided with cortical-cells.

Remarks. As was already pointed out the third series has to be renamed. Therefore BRAUN's name for the present series is substituted at the same time, as it would otherwise become a permanent source of confusion.

18. **Chara aspera** [1]) WILLDENOW in Mag. Ges. naturf. Freunde Berl. 3, 1809, p. 298; AGARDH, Syst. Alg., 1824, p. 130; BRUZELIUS & FUERNROHR in Flora 9, 1826, p. 490; BRAUN in Ann. Sci. Nat. Sér. 2, 1834, p. 356, *pro parte*; id. in Flora 18, 1835, p. 71, excl. var.; KUETZING, Phyc. Germ., 1845, p. 257; BRAUN in N. Denkschr. Schw. Ges. Naturw. 10, 1849, p. 20; KUETZING, Spec. Alg., 1849, p. 521; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 79; KUETZING, Tab. Phyc. 7, 1857, p. 21, pl. 51, f. 2 [2]), pl. 52; BRAUN, Consp. syst. Charac. europ., 1867, p. 6; id. in Monatsb. Kön. Akad. Wiss. Berlin f. 1867, p. 851, 1868; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 22, 174; T. F. ALLEN, Americ. Charac. 1, 1888, p. 60 (*nom. tant.*); NORDSTEDT in Lunds Univ. Års-skr. 25, 1889, p. 37; GIESENHAGEN in Flora 82, 1896, p. 3, figs. 1—10; MIGULA, Die Charac., 1897, p. 653, figs. 134—135; id., Syn. Charac. europ., 1898, p. 140, figs. 119—120; ROBINSON in Bull. New York Bot. Gard. 4, 1906, p. 281; STROEDE, Oekol. Charac. 1931, p. 38, pl. 2, f. 7; G. O. ALLEN in Journ. Ind. Bot. Soc. 12, 1933, p. 17, pl. 1; VERDAM in Blumea 3, 1938, p. 26 — *Chara pulchella* WILLD. var. *aspera* WILLDENOW in WALLROTH, Flor. Crypt. German. 1833, p. 109 — *Chara aspera* WILLD. var. *Macounii* T. F. ALLEN in Bull. Torrey Bot. Cl. 9, 1882, p. 44, pl. 21 — *Chara Macounii* (T. F. ALLEN) ROBINSON in Bull. New York Bot. Gard. 4, 1906, p. 281.

Plant dioecious. *Stem* slender, up to 500 μ in diam. *Internodes* 2—3 times the length of the branchlets. Whitish spherical *bulbils* present at the root-nodes, solitary or in clusters of 2—6. *Stem-cortex* triplostichous, cells of the primary series larger than those of the secondary ones. *Spine-cells* solitary or sometimes 2—3 together, slender, acute, often with a bulbous base, up to $2\frac{1}{2}$ times as long as the stem diam. *Stipulodes* in a double whorl, both whorls usually equally developed; the cells of the upper whorl are sometimes as long as the lowest branchlet-articulation. *Branchlets* 8—9 in a whorl, straight or slightly incurved, composed of 6—8 articulations, of which the ultimate 1 or 2 are ecorticate and very acute, the other ones triplostichous. *Bract-cells* usually 5, lateral and anterior ones almost always exceeding the oogonia in length, posterior ones usually shorter than the oogonium. *Bracteoles* and *bractlet* somewhat longer than the anterior bract-cells. ♂ and ♀ *gametangia* solitary, at the four lowest nodes. *Antheridia* 400—600 μ in diam. *Oogonia* 600—800 μ long (excl. coronula), 400—550 μ wide; *spiral-cells* showing 13—15 convolutions; *coronula* 75—100 μ

[1]) An extensive list of the European literature, the synonyms and the figures are to be found in MIGULA (1897, pp. 653—654), GROVES & BULLOCK WEBSTER (1924, p. 51).

[2]) The piece of the stem in fig. f has a haplostichous cortex instead of a triplostichous one.

high, 120—200 μ wide at base; *oospores* black, 400—650 μ long, 250—400 μ wide, with 12—14 ridges, terminating in small basal claws.

Remarks. ALLEN (1933, p. 19) states that the specimens collected by him in India differs from the European plants by having small roundish spine-cells instead of long spines. *C. aspera* is at once characterized by having spherical whitish bulbils at the lower nodes, which do not occur in any other dioecious triplostichous *Chara* from Malaysia. These, *C. infirma* and *C. connivens* have both rudimentary spine-cells. No Malaysian plants seen.

Ecology. *Chara aspera* is a slender plant, usually occurring in lakes and large pools. There is a correlation between its being incrusted with lime, the presence of long spine-cells and a stout appearance.

In Germany it is found growing in anorganotrophic water with a pH of 7.42—8.06. The water in which it occurs may also have a high content of Cl, though it is often found in fresh water too. STROEDE (1931, p. 49) remarks that the Cl-content may vary from 16 to 3535 mg per l.

Chara baltica and *C. contraria* were collected in the same localities. STROEDE records as inhabitants of the same water in the island of Rügen: *Potamogeton pectinatus, Ulva lactuca, Enteromorpha intestinalis, Fucus vesiculosus*, etc. Though *C. aspera* usually occurs at a depth of 0.5—3 m, it is sometimes collected in much deeper water.

ALLEN (1933, p. 19) found it in India from February to the end of March.

Distribution. Between 70° N. and 25° N.; EUROPE, cf. BRAUN & NORDSTEDT (1882, p. 174); MIGULA (1897, p. 660); GROVES & BULLOCK WEBSTER (1924, p. 52) — ASIA, India: Gangetic Plain, ALLEN (1933, p. 17); Turkestan, ex GROVES & BULLOCK WEBSTER (1924, p. 53) — AMERICA, N. Am.: Canada, Saskatchewan, T. F. ALLEN (1882, p. 44); ROBINSON (1906, p. 282); New Foundland; United States, BRAUN & NORDSTEDT (1882, p. 175), ROBINSON (1906, p. 282) — AFRICA, N. Afr.: Algeria, BRAUN (1868, p. 852).

19. Chara infirma A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 22, 177, pl. 7, figs. 264—266; id. in herb. HOOKER 1862 (*nom. tant.*); T. F. ALLEN, Amer. Charac. 1, 1888, p. 60 (*nom. tant.*); GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 363, 374.

Plant dioecious, incrusted, not known to produce bulbils. *Stem* slender, 480—540 μ in diam. *Stem-cortex* triplostichous, cells of the primary and secondary series usually equal developed. *Spine-cells* very minute, up to 60 μ long. *Stipulodes* in a double whorl, strongly developed, those of the upper whorl somewhat longer. *Branchlets* 7—10 in a whorl, slightly spreading, composed of 6—7 articulations of which the ultimate 1—2 are ecorticate, the other ones triplostichous. *Bract-cells* 7—8, rigid, acuminate, the anterior ones well developed, 2—2½ times the length of the immature oogonium, the posterior 2—3 rudimentary. *Bracteoles* similar to but shorter than the anterior bract-cells. ♂ and ♀ *gametangia* at the four lowest branchlet-nodes, solitary. *Antheridium* 500—600 μ in diam. *Immature oogonium* 540—620 μ long, 420—480 μ wide. *Oospore* probably light-brown.

Remarks. BRAUN described this species as "dubia", since no mature female plants and no root parts were collected. Afterwards it is recorded only once, viz. by GROVES (*l.c.* p. 374), who could not detect ripe oogonia either. It is separable from the other dioecious triplostichous species by having strongly

developed stipulodes together with rudimentary spine-cells. Not having seen a specimen, I extracted the type description.

Ecology. GROVES (*l.c.*, p. 375) states that the species occurs in India at an elevation of 300—1800 m.

Distribution. Between 38° N. and 27° N.; ASIA, Persia, Afghanistan, BRAUN & NORDSTEDT (1882, p. 179); India: West Himalaya, India Deserta, GROVES (1924, p. 375).

20. Chara connivens[1]) SALZMANN ex A. BRAUN in Flora 18, 1835, p. 73; KUETZING, Spec. Alg., 1847, p. 521; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 82; KUETZING, Tab. Phyc. 7, 1857, p. 26, pl. 63, f. 1; BRAUN in SCHWEINFURT, Beitr. z. Flor. Aethiop., 1867, p. 180; id., Consp. syst. Charac. europ., 1867, p. 7; id., in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 855, 1868; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 23, 180; T. F. ALLEN, Americ. Charac. 1, 1888, p. 62 (*nom. tant.*); MIGULA, Die Charac., 1897, p. 703, figs. 142—143; id., Syn. Charac. europ., 1898, p. 152, figs. 127—128; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, p. 57, pl. 41; FILARSZKY in Math. u. Naturwiss. Anz. d. Ungar. Akad. Wiss., 55, 1937, pp. 482, 484; VERDAM in Blumea 3, 1938, p. 29; HASSLOW in Botan. Not. Lund, 1939, p. 299.

Plant dioecious, bright-green, very brittle though not much incrusted, glossy. *Bulbils* not observed. *Stem* slender, rigid. *Stem-cortex* triplostichous, cells of the primary and secondary series of equal prominence. *Spine-cells* rudimentary. *Stipulodes* in a double whorl, rudimentary. *Branchlets* 6—10 in a whorl, rigid, especially in the male plant strongly incurved, consisting of 6—13 articulations of which the upper 1—2 are ecorticate, the other ones triplostichous. *Bract-cells* c. 7, hardly developed, at sterile nodes 1—3, anterior ones papilliform; at fertile nodes of female plants 3—5, anterior ones elongated though much shorter than the oogonium; at fertile nodes of male plants 2. *Bracteoles* and *bractlet* similar to the anterior bract-cells. ♂ and ♀ *gametangia* solitary, at the 3—4 lowest nodes. *Antheridia* 800—1100 μ in diam. (in the var. *pygmaea* 500—600 μ). *Oogonia* 850—1150 μ long (incl. coronula), 320—550 μ wide, *spiral-cells* showing 13—14 convolutions; *coronula* c. 200 μ high, c. 185 μ wide at base, individual cells strongly connivent; *oospores* black, 580—700 μ long, 240—350 μ wide, showing 12—13 faint ridges, terminating into inconspicuous basal claws (in var. *pygmaea* the sizes are, according to BRAUN [1868, p. 858]: *oogonium* 780—800 μ long, 360—380 μ wide; *coronula* 140—150 μ high; *oospores* 480—520 μ long, 240—260 μ wide).

Remarks. *Chara connivens* is one of the two dioecious members of the *Triplostichae* having reduced stipulodes, spine-cells, and branchlets. From *C. fragifera*, from Europe and Africa, it is distinguished by its more robust stem, the markedly connivent branchlets, the fewer number of branchlet-articulations, the long conical coronula, and especially by the lack of whitish bulbils at the lower stem- and root-nodes. I did not see an Indian specimen.

Ecology. This slender species prefers in Europe and Africa brackish

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[1]) Only some of the principal European papers are cited here, for further literature cf. MIGULA (1897, p. 703) and GROVES & BULLOCK WEBSTER (1924, p. 57).

waters, though it may also be found in fresh water. It has been found growing together with *Chara Braunii* and *C. globularis*. In Africa it is found from March to July and the only record from India is dated April.

Distribution. Between 55° N. and 25° N.; EUROPE, cf. BRAUN & NORDSTEDT (1882, p. 180), MIGULA (1897, p. 708), GROVES & BULLOCK WEBSTER (1924, p. 58) — ASIA, Palestine, ex GROVES & BULLOCK WEBSTER (1924, p. 58); India: Gangetic Plain, FILARSZKY (1937, p. 484) — AFRICA, N. Afr.: Algeria, Tunisia, Egypt, BRAUN (1868, p. 857).

21. Chara globularis [1]) THUILLER, Flor. Env. Paris, ed. 2, 1799, p. 472; PERSOON, Syn. Plant., 2, 1807, p. 530 — *Chara Hedwigii* AGARDH apud BRUZELIUS, Observ. Charac., 1824, pp. 7, 21; AGARDH, Syst. Alg., 1824, p. 129; BRUZELIUS & FUERNROHR in Flora 9, 1826, p. 489; CHEVALLIER, Flor. Génér. Env. Paris, 1827, p. 126, *pro parte*; KUETZING, Tab. Phyc. 7, 1857, p. 23 — *Chara pulchella* WALLROTH *β globularis* THUILL., WALLROTH, Flor. Crypt. Germ., 1883, p. 108 — *Chara fragilis* DESVAUX, A. BRAUN in Flora 18, 1835, p. 68, *pro parte*; id., in Ann. Sci. Nat. Bordeaux, sér. 2, 1834, p. 356; KUETZING, Phyc. germ., 1845, p. 257, *pro parte*; id., Spec. Alg., 1849, p. 521, *pro parte*; RUPRECHT, Beitr. Pflanz. Russ. Reich. 1, 1844, p. 16; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin 1882, pp. 23, 181, *pro parte*; H. & J. GROVES in Journ. Linn. Soc., Bot., 37, 1906, p. 286 — *Chara fragilis* DESV. var. *elongata* KUETZING, Spec. Alg., 1849, p. 521 — *Chara fragilis* DESV. var. *Hedwigii* (AGARDH) WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 84; KUETZING, Phyc. Gen., 1843, p. 319; A. BRAUN, Consp. syst. Charac. europ. 1867, p. 7; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, p. 64 — *Chara fragilis* DESV. var. *major-longifolia* A. BRAUN, HALSTED in Proc. Boston Soc. Nat. Hist. 19, 1879, p. 188 — *Chara fragilis* DESV. f. *Hedwigii* (AGARDH) MIGULA, Die Charac., 1897, p. 730; id., Syn. Charac. europ., 1898, p. 158; VERDAM in Blumea 3, 1938, p. 32 — *Chara capillacea*; *C. fragilis* ssp. et var. *capillacea*, ssp. *fragilis* var. *pulchella*; var. *subverrucosa*, var. *subverrucosa* f. *platensis*; *C. hirta*; *C. pulchella*; *C. viridis*; cf. var. *capillacea*.

Illustrations. KUETZING, Tab. Phyc. 7, 1857, pl. 55, f. 1; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, pl. 43.

Plant monoecious, dull green, up to 60 cm high (MIGULA collected plants in Germany of 1 m in length [1897, p. 730]). *Stem* stout, 1000—1400 μ in diam. *Internodes* 1½—2 times the length of the

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[1]) MIGULA (1897, pp. 722—723) and GROVES & BULLOCK WEBSTER (1924, pp. 61—62, 64—65) cite more synonyms, figures and European literature.

branchlets. Irregular multicellular *bulbils* sometimes present. *Cortex* triplostichous, cells of primary and secondary series of equal width. *Spine-cells* extremely small, only visible in very young internodes. *Stipulodes* in a double whorl, greatly reduced and inconspicuous. *Branchlets* 7—8 in a whorl, straight, very long, up to 6 cm, consisting of 8—10 articulations of which the upper 1—3 are ecorticate, cortical-cells on branchlets twice as numerous as the bract-cells. *Bract-cells* c. 7, varying in length, equal or somewhat shorter than the oogonium, only one anterior pair developed, posterior cells rudimentary at fertile nodes, at sterile nodes frequently wanting. *Bracteoles* sometimes developed, shorter or as long as the oogonium. ♂ and ♀ *gametangia* solitary, at the 3—4 lowest branchlet-nodes. *Antheridia* 300—500 μ in diam. *Oogonia* 800—1100 μ long (incl. coronula), 500—700 μ wide; *spiral-cells* showing 14—17 convolutions; *coronula* 175—250 μ high, 200—375 μ wide at base, individual cells erect and connivent, usually truncate at the apex; *oospores* black, 500—700 μ long, 350—450 μ wide, with 12—15 well pronounced ridges prolonged downwards into a cage.

Remarks. The present species was hitherto known as *Chara fragilis* Desv., though more than one author has remarked that this name had to be substituted. Moreover, Braun knew that *C. globularis* was identic with *C. Hedwigii* and considered the latter a form of Desvaux' *C. fragilis*. The same author states (1876, p. 395, note 1), that Thuiller's *C. globularis* was established on specimens of *C. fragilis* with a colourless oospore membrane. The oospore is globular and looks white, containing a considerable quantity of starch. Braun supposes that this is due to non-fertilization, as the same process can be found in almost every species. This, however, is not a reason to neglect the name of Thuiller and to use the later one of Desvaux.

At the Rijksherbarium at Leiden there are five specimens extant in the herbarium of Persoon, two of these being labelled by himself as follows: 1. "*Chara capillaris* Thuill."; 2. "*Chara viridis. Chara capillaris* Th., prope Parisios". On the labels of the other three specimens Persoon himself has only written: "Thuiller". Above this word stands the name of the plant written in another script, which I could not identify with one of the handwritings from the collection extant in the Rijksherbarium. Label 3 bears the name: "*Chara capillacea*", label 4: "*Chara funicularis*" and label 5: "*Chara globularis*". Most probably this handwriting hails from Thuiller himself, but as there was no original handwriting from him in the collection I could

not state this with certainty. According to LÜTJEHARMS (1938, p. 42), PERSOON lived at Paris from 1800—1836, and as he was perfectly well connected with contemporary colleagues, it is probable that the plants were determined by THUILLER.

Afterwards all these plants were seen by BRAUN who determined them as follows: 1. "*Chara fragilis* DESV. forma *tenuifolia* (*Ch. capillacea* THUILL.)"; 2 and 3: "*Chara fragilis* DESV."; 4. "*Chara fragilis* var. *Hedwigii* (*Ch. globularis* THUILL. non *Ch. funicularis* THUILL.)"; 5: "*Chara fragilis* DESV. var. *Hedwigii*, semin. degeneratis (*Ch. globularis* THUILL.)".

Especially BRAUN's remark on sheet 5 "semin. degeneratis" led me to the conclusion that this must be the type or a cotype. As I identified the specimens on sheets 4 and 5 as *C. globularis* var. *Hedwigii* (no root parts are preserved) there is no doubt that THUILLLER's name is valid and must be accepted.

The plants with a much smaller habit, more slender stem, shorter internodes and branchlets are now considered a variety for which the name *capillacea* THUILLLER (non WALLMAN) has to be used. To this variety belong the Indian plants to be described below.

Chara globularis can only be confused with *C. brachypus*, another monoecious member of the *Triplostichae* which has, however, well developed stipulodes, and a branchlet-cortex with cells about three times as numerous as the bract-cells. *C. zeylanica* has the lowest branchlet-articulation ecorticate. For reasons pointed out under the remarks of var. *capillacea* I mention the ecology here.

E c o l o g y. *Chara globularis* is a cosmopolitan species, dull to greyish-green according to its being more or less incrusted, and varying in height from c. 25 cm up to 1 m. These larger forms are the typical ones (var. *Hedwigii*), whereas the plants of var. *capillacea* are more tiny. As the plants are usually brittle, the dried specimens are often broken up.

The species occurs in fresh water, not in tufts as *C. delicatula* does, but some collectors found it in brackish water. STROEDE records it from Rügen from water with 3332 mg Cl per l. This water may be anorganotrophic or organotrophic, though the latter is preferred. As to the pH, STROEDE found that the optimum range is 7—7.8. *C. globularis* is able to withstand a considerable range in temperature as it is known from the hot springs in Iceland, "the temperature of the spring in which this plant was growing was such as to boil an egg in four minutes" (cf. BRAUN & NORDSTEDT, 1882, p. 182), and in "Yellowstone Park, in Geyser springs, temperature 100° F." (T. F.

ALLEN, 1882, p. 46), whereas T. F. ALLEN records it also "in ice water at the north".

Specimens of the var. *capillacea* have been found in stagnant water of little and large water-basins, in lowland country and mountainous areas, i. e. 1050 m in Flims (Switzerland, BRAUN, 1849, p. 22), whereas the typical forms prefer somewhat running water. It usually occurs at no greater depth than 1 m.

On account of its being eurytrophic *C. globularis* has often been found growing together with a number of other *Charophyta*. Higher aquatic plants growing in the same locality are in Europe: *Phragmites communis, Typha angustifolia, Scirpus lacustris, Butomus umbellatus, Nymphaea alba, Nuphar luteum, Myriophyllum spicatum, Potamogeton pectinatus*; in Malaysia: *Ceratophyllum demersum, Potamogeton crispus, P. pectinatus, Myriophyllum verticillatum* (MUKERJI, 1932, p. 328).

Ripe oospores are found in Germany from June to September (STROEDE, 1931, p. 31), in India from November to May (ALLEN, 1928, p. 66).

With regard to the light-intensity MUKERJI (1932, p. 328) states, that it shows a great tolerance towards very low intensities of light, being also fully capable of growing in very bright light. The same author states that in Dal Lake, *C. globularis* is found up to a depth of 6 m, whereas in Manasbal Lake, in which the water is six to eight times clearer than in Dal, *C. globularis* extends further down to a depth of about 7.5 m.

Distribution[1]). Between 70° N. and 50° S.; ASIA, India; Indo-China; cf. var. *capillacea*. Moreover in lit.: EUROPE, cf. BRAUN & NORDSTEDT (1882, pp. 181—182), MIGULA (1897, p. 728), GROVES & BULLOCK WEBSTER (1924, pp. 63—64) — ASIA: Siberia, Kamchatka, BRAUN & NORDSTEDT (1882, p. 38); NORDSTEDT (1889, p. 38); Songaria, RUPRECHT (1884, p. 16); Altai, BRAUN & NORDSTEDT (1882, p. 182); Japan, ALLEN (1894, p. 523); India: West Himalaya, GROVES (1924, p. 375), MUKERJI (1932, p. 328; 1934, p. 295); Malabaria, GROVES (1924, p. 375), DIXIT (1935, p. 261); Gangetic Plain, GROVES (1924, p. 375), ALLEN (1925, p. 597), GROVES & ALLEN (1927, p. 339), ALLEN (1928, p. 64; 1933, p. 17; 1936, p. 51); Bengal, BRAUN & NORDSTEDT (1882, p. 182), AGHARKAR & KUNDU (1937, p. 17); Malaysia, Lombok (Segara Anak), VAN DER VEEN (1937,

[1]) Including the distribution of the var. *capillacea*.

p. 198 [1]) — AMERICA, N. Am.: Canada, BRAUN & NORDSTEDT (1882, p. 183), NORDSTEDT (1889, p. 38), ROBINSON (1906, p. 279); New Foundland; United States, BRAUN & NORDSTEDT (1882, p. 183); C. Am.: Mexico, BRAUN & NORDSTEDT (1882, p. 183), ROBINSON (1906, p. 279); S. Am.: Peru, BRAUN & NORDSTEDT (1882, p. 183), Uruguay, BRAUN & NORDSTEDT (1882, p. 866); Spegazzini (1883, p. 229), ALLEN & HERTER (1934, p. 91) — AFRICA, N. Afr.: Algeria, NORDSTEDT (1889, p. 38); Egypt, Canary Islands, BRAUN (1868, p. 866); S. Afr.: Cape Colony, BRAUN (1868, p. 866), GROVES (1906, p. 286); Madagascar, GROVES (1928, p. 135), ZANEVELD (1939, p. 382) — AUSTRALIA, W. Austr.: Darebin Creek (?), BRAUN & NORDSTEDT (1882, p. 183); Moores River, Nepean River, Port Philip, NORDSTEDT (1889, p. 38); S. Austr., Torrens River, BRAUN & NORDSTEDT (1882, p. 182); Queensland, NORDSTEDT (1889, p. 192), BAILEY (1909, p. 682), GROVES & ALLEN (1935, p. 58); N. S. Wales, HASSLOW (1939, p. 301); Victoria, NORDSTEDT (1889, p. 192); Tasmania, BRAUN & NORDSTEDT (1882, p. 183), NORDSTEDT (1889, p. 38); New Zealand, NORDSTEDT (1880, p. 20; 1888, p. 192), BRAUN & NORDSTEDT (1882, p. 39).

var. α **capillacea** (THUILLER) ZANEV., nov. comb. — *Chara vulgaris* L., Spec. Plant., 1753, p. 1156, *pro parte* — *Chara capillacea* THUILLER (non WALLMAN), Flor. Env. Paris, 1799, p. 174; PERSOON, Syn. Plant., 1807, p. 530; CHEVALLIER, Flor. gén. env. Paris, 1827, p. 126; KUETZING, Tab. Phyc. 7, 1857, p. 23 — *Chara fragilis* DESVAUX apud LOISELEUR, Not. Pl. aj. Flor. France, 1810, p. 137; A. BRAUN in Ann. Sci. Nat. Bot. sér. 2, 1834, p. 356, *pro parte*; id. in Flora 18, 1835, p. 68, *pro parte*; KUETZING, Phyc. gen., 1843, p. 319, *pro parte*; id., Phyc. germ., 1845, p. 257, *pro parte*; id., Spec. Alg., 1849, p. 521, *pro parte*; A. BRAUN in N. Denkschr. Schw. Ges. Naturw. 10, 1849, p. 21; id. in Linnaea 25, 1852, p. 709; id. in HOOKER's Flor. Tasman. 3, 1860, p. 160; id., Consp. syst. Charac. Europ., 1867, p. 7; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 866, 1868; id. in COHN's Krypt. Flor. Schles. 1, 1876, p. 410; HALSTED in Proc. Boston Soc. Nat. Hist., 1879, p. 188; NORDSTEDT in Lunds Univers. Års-skr. 16, 1880, p. 20; T. F. ALLEN in Torrey Bot. Cl. 9, 1882, p. 45; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 23, 182, *pro parte*; T. F. ALLEN, Charac. Americ. 1, 1888, p. 62 (*nom. tant.*); NORDSTEDT in Lunds Uni-

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[1]) It should be added that I have not seen this specimen and as it is probably not preserved, the occurrence of this species in the Netherlands Indies is not certain.

vers. Års-skr. 25, 1889, p. 38; T. F. ALLEN in Bull. Torrey Bot. Cl. 21, 1894, p. 523; MIGULA, Die Charac., 1897, p. 722; id., Synops. Charac. europ., 1898, p. 158; ROBINSON in Bull. New York Bot. Gard. 4, 1906, p. 279; BAILEY, Compreh. Cat. Queensl. Pl., 1909, p. 682; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 363, 375; G. O. ALLEN in Journ. Bomb. Nat. Hist. Soc. 30, 1925, p. 597; GROVES & ALLEN in Journ. Bot., 1927, p. 339; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 64; J. GROVES in Journ. Linn. Soc., Bot., 48, 1928, p. 135; STROEDE, Oekol. Charac., 1931, p. 31; MUKERJI in Proc. 19th Ind. Sci. Congr., Bangalore, 1932, p. 328; id. in Proc. 21th Ind. Bot. Congr., Bombay, 1934, p. 295; G. O. ALLEN in Journ. Ind. Bot. Soc. 12, 1933, p. 17; DIXIT, in Journ. Ind. Bot. Soc. 14, 1935, p. 261; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 58; G. O. ALLEN in Journ. Ind. Bot. Soc. 15, 1936, p. 51; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, p. 17; VERDAM in Blumea 3, 1938, p. 31; ZANEVELD in Blumea 3, 1939, pp. 381—382; HASSLOW in Bot. Not. Lund, 1939, pp. 298, 301 — *Chara pulchella* WALLROTH, Annus Bot., 1815, p. 184; id., emend. Flor. Crypt. Germ., 1833, p. 108; AGARDH, Syst. Alg., 1824, p. 129 — *Chara hirta* MEYEN in Linnaea 2, 1827, p. 78 — *Chara fragilis* DESV. ap. LOIS. ssp. *capillacea* (THUILL.) WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 85 — *Chara gracilis* SPR. var. *capillacea* (THUILL.) WALLROTH, Flor. Crypt. Germ., 1883, p. 109 — *Chara fragilis* DESV. ap. LOIS. ssp. *fragilis* DESV. var. *pulchella* (WALLR.) WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 84 — *Chara viridis* HARTMAN, Handb. Skand. Flor., ed. 1, 1820, p. 376 — *Chara fragilis* DESV. ap. LOIS. β *subverrucosa* A. BR. in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 182 — *Chara fragilis* DESV. ap. LOIS. β *subverrucosa* A. BR. f. *platensis* SPEGAZZINI in Anal. Soc. Cient. Agent. 15, 1883, p. 229; ALLEN & HERTER in Revist. Sudamer. Bot. 1, 1934, p. 91.

Illustrations. KUETZING, Tab. Phyc. 7, 1857, pl. 54, pl. 55, f. 2; T. F. ALLEN in Bull. Torr. Bot. Cl. 9, 1882, pl. 22; MIGULA, Die Charac., 1897, figs. 146, 147; id., Syn. Charac. europ., 1898, figs. 131, 132; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, pl. 1; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, pl. 8, figs. 4—6, pl. 9, f. 1.

Plant small, slender, and more tiny than the typical var. *Hedwigii*, slightly incrusted. *Stem* rather slender, c. 750 μ in diam., very brittle. *Internodes* nearly as long as the branchlets. *Branchlets* 4—30 mm long, usually a little incurved at their base. ♂ and ♀ *gametangia* usually at the three lowest nodes, rarely at the fourth.

INDIA: "India orientalis", without exact locality and date, GRIFFITH

s.n. (B); Gangetic Plain, Behar, no date and collector's name, ex herb. HOOKER 1858 (B); Bengal, without exact locality, date and collector's name, ex herb. HOOKER 1853 (B).

INDO-CHINA: W. Tonkin, without exact locality and date, BON 2435 (P).

Remarks. As both the varieties *Hedwigii* and *capillacea* have been generally combined, the distribution and the ecology of both is cited on pp. 194, 195. However, most probably var. *Hedwigii* is restricted to the Northern Temperate zone.

Distribution. Between 25° N. and 20° N.; ASIA, India; Indo-China.

22. Chara delicatula[1]) AGARDH em. A. BRAUN, Syst. Alg. 1824, p. 130 (non *C. delicatula* DESVAUX); BRAUN in COHN's Krypt. Flor. Schles. 1, 1876, p. 411; MIGULA, Die Charac., 1897, pp. 752, f. 148; id. Syn. Charac. europ., 1898, p. 164, f. 133; ROBINSON in Bull. New York Bot. Gard. 4, 1906, p. 280; KUCZEWSKI in Beih. Bot. Centralbl. 20, 1906, p. 25; GROVES & BULLOCK WEBSTER, Brit. Charoph. 2, 1924, pp. 65—69, pl. 44; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 64 — *Chara pulchella* WALLR. var. *delicatula* WALLROTH, Flor. Crypt. Germ., 1833, p. 108 — *Chara virgata* KUETZING, in Flora 17, 1834, p. 705; id., Tab. Phyc. 7, 1857, p. 23, pl. 56, f. 2 — *Chara fragilis* DESV. ap. LOIS. var. *longibracteata* RABENHORST, Deutschl. Krypt. Fl. 2, 1847, p. 200; A. BRAUN in N. Denkschr. Schweiz. Ges. Naturw. 10, 1849, p. 21 — *Chara verrucosa* ITZIGSOHN in Bot. Zeit., 1850, p. 338; ROBINSON in Bull. New York Bot. Gard. 4, 1906, p. 280; VERDAM in Blumea 3, 1939, p. 33 — *Chara fragilis* DESV. ap. LOIS. var. *delicatula* VON LEONHARDI in Verh. Naturf. Verein. Brünn 2, 1864, p. 209; A. BRAUN, Consp. syst. Charac. europ., 1867, p. 7; HASSLOW in Bot. Not. Lund, 1939, p. 298 — *Chara fragilis* DESV. ap. LOIS. ssp. *delicatula* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 184, pl. 7, figs. 269—270; T. F. ALLEN, Charac. Americ. 1, 1888, p. 62.

Plant monoecious, up to 15 cm long, sometimes incrusted. *Stem* slender, 375—500 μ in diam. *Internodes* as long as to twice as long as the branchlets. *Stem-cortex* triplostichous, primary cortical-cells more developed than the secondary ones. *Spine-cells* developed, usually very minute. *Stipulodes* in a double whorl, well developed, those of the upper whorl sometimes much longer than those of the rudimentary lower whorl. *Branchlets* 7—8 in a whorl, composed of 8—11 articulations of which the upper 1—3 are ecorticate, the other ones diplostichous. *Bract-cells* 5—7, posterior ones not developed, anterior ones ½—1 times the length of the oogonium. *Bracteoles* somewhat longer than the oogonium. ♂ and ♀ *gametangia* together at the three lowest branchlet-nodes, solitary. *Antheridia* 350—560 μ in diam. *Oogonia* 850—1200 μ long (incl. coronula), 500—700 μ wide; *spiral-cells* showing 14—15 convolutions; *coronula* 100—240 μ high, 180—260 μ wide at base, individual cells connivent, oblong-lanceolate; *oospores* black, 625—720 μ long, 340 –550 μ wide with 12—14 ridges, terminating in basal claws.

[1]) Only the principal synonyms and european literature are cited; more information is to be found in MIGULA (1897, p. 752) and in GROVES & BULLOCK WEBSTER (1924, pp. 65—66).

Remarks. This species closely resembles *C. globularis* from which it is distinguished by having the primary cortical-cells more developed, the stipulodes more elongated and the spine-cells very small. These characters, however, are variable, and therefore one may favour the view to regard *C. delicatula* as a subspecies of *C. globularis*. As I have only seen European material I will not give a decision at present. Though DESVAUX (1810, p. 137) was the first in using the name *delicatula*, he is not cited as an author because his specimen was a representative of *C. aspera* (according to BRAUN).

BRAUN distinguishes two series of plants, viz. *bulbilifera* with one-celled stem bulbils at the lower nodes, and *verrucosa*, without such bulbils. G. O. ALLEN (1928, p. 64) does not say to which series the plant from Benares belongs.

Ecology. *Chara delicatula* is usually a tiny plant, never growing as tall as *C. globularis*. It is found in the same ponds, pools, lakes and streams as the last-named species; in Great Britain it is especially common in the moorland districts.

Distribution. Between 70° N. and 50° S.; EUROPE, BRAUN & NORDSTEDT (1882, p. 184); MIGULA (1897, p. 755); GROVES & BULLOCK WEBSTER (1924, p. 67) — ASIA, Siberia, BRAUN & NORDSTEDT (1882, p. 184); Japan, ex GROVES & BULLOCK WEBSTER (1924, p. 67); India: BENARES, ALLEN (1924, p. 64) — AMERICA, N. Am.: Connecticut, California, BRAUN & NORDSTEDT (1882, p. 184); Alaska, Maine, New York, ROBINSON (1906, p. 280); Long Island, T. F. ALLEN (1882, p. 46) — AFRICA, S. Afr., ex GROVES & BULLOCK WEBSTER (1924, p. 67, without exact locality).

23. **Chara inermis** ZANEV., nov. spec.

Illustrations. The pres. paper, figs. 20*a*—*d*.

Planta monoica, fragilis, glaucescens, ad 25 cm alta. *Caulis* robusta, usque ad 1200 μ diam. *Internodia* ramulis ½—4-plo longiora. *Cortex* regulariter triplostichus; cellulis primariis et secundariis subaequaliter prominentibus. *Spinulae* deficientes. *Stipulodia* biseriata, ramulis duplex longiora acuta, stipulodia seriei superioris valde evoluta, 525 μ longa, 95 μ lata; seriei inferioris 315 μ longa, 60 μ lata. *Verticillorum ramuli* 7—10, triplostiche corticati, 8—9 articulationibus, segmento inferiori subdiaphano, supremis 1—3 ecorticatis. *Bracteae* 2 anteriores evolutae, posteriores rudimentariae. *Bracteoli* 225—450 μ longi, 105 μ lati. ♂ et ♀ *gametangia* solitaria, in omnibus nodis corticata. *Antheridia* 255—300 μ diam. *Oogonia* (coronula inclusa) 650 μ longa, 405 μ lata, strias 11—12; *coronula* 105 μ alta, basi 150 μ lata; *oosporae* nigrae, 450 μ longae, 365 μ latae, striis 9—10.

Plant monoecious, greyish green, not at all incrusted, brittle, probably taller than 25 cm. *Stem* robust, up to 1200 μ in diam. *Internodes* ½—4 times as long as the branchlets. *Cortex* regularly triplostichous, cells of the primary and secondary cortical series equally prominent, cortical node-cells extremely small. *Spine-cells* absent.

Stipulodes forming a double whorl, twice as numerous as the branchlets, acute, stipulodes of the upper whorl 525 μ long, 95 μ wide, shorter or as long as the lowest branchlet-internode, somewhat incurved, those of the lower whorl 315 μ long, 60 μ wide. *Branchlets* 7—10, consisting of 8—9 articulations, the lowest one triply corticated but subdiaphanous (without chlorophyll), the ultimate 1 or 2, (rarely 3) ribbon-shaped and, ecorticate, the other articulations triplostichous. *Bract-cells* 2, only the anterior present, small, 165—425 μ long, c. 75 μ wide, acute, the up to 4 papillae scarcely visible, bract-cells wanting at sterile nodes. *Bracteoles* similar to the bract-cells, 225—450 μ long, c. 105 μ wide. ♂ and ♀ *gametangia* solitary, at all corticated nodes, and at the same nodes. On account of the shortness of the first articulation, they seem to be situated at the base of the branchlets. *Antheridia* 255—300 μ in diam. *Oogonia* 650 μ long (incl. coronula), 405 μ wide; *spiral-cells* showing 11—12 convolutions; *coronula* 105 μ high, 150 μ wide at base, individual cells ovate, diverging at the apex; *oospores* black, 450 μ long, 365 μ wide, with 9—10 ridges.

SOEMBA: Nabeso, in a swamp, 27 III 1925, Soemba Expedition, IBOET 126, (L, *type*; Bz, cotype).

Remarks. This species is very closely allied to *Chara brachypus* and *C. pseudo-brachypus,* from both it is to be distinguished by the absence of spine-cells. Moreover, the habit of the plant is more robust than in the two species mentioned, though the ripe oospores are smaller. In a dried state the specimens have a rhomboid-like texture on the cortex. It differs from *C. globularis* by its triplostichously corticated branchlets, the very short lowest branchlet-articulation, very well developed stipulodes and smaller gametangia, from *C. infirma* by being monoecious and from *C. zeylanica* by the corticated, yet subdiaphanous lowest branchlet-articulation, and from all three mentioned *Triplostichae* by the absence of spine-cells even in the younger parts.

Ecology. The only ecologic informations at hand concerning this species are that it inhabits swamps, and that plants with ripe oospores have been found in March.

Distribution. 10° S.; ASIA, Malaysia: Soemba.

24. Chara brachypus A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 298; KUETZING, Spec. Alg., 1849, p. 522; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 58; KUETZING, Tab. Phyc. 7, 1857, p. 24; A. BRAUN in SCHWEINFURTH, Beitr. z. Fl. Aethiop., 1867, p. 230; id., in Monatsb. Kön. Akad. Wiss. Berlin f. 1867, p. 939, 1868; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, pp. 23, 185; T. F. ALLEN, Charac.

Amer. 1, 1888, p. 62 (*nom. tant.*); NORDSTEDT in Forsch. Reise S. M. S. "Gazelle", 4 Th., Bot. 1889, p. 8; DE WILDEMAN, Prodr. Flor. Alg. Ind. Néerl., 1897, p. 30; id., Suppl. et Tabl. Stat. 1899, p. 96; H. & J. GROVES in Philipp. Journ. Sci. Bot. 7, 1912, p. 70; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, pp. 363, 375; G. O. ALLEN in Journ. Bomb. Nat. Hist. Soc. 30, 1925, p. 597; J. GROVES in Journ. Linn. Soc., Bot., 48, 1927, p. 135; GROVES & ALLEN in Journ. Bot. 65, 1927, p. 339; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 65; DIXIT in Journ. Ind. Bot. Soc. 10, 1931, p. 206; PAL in Journ. Burma Res. Soc. 18, 1929, p. 113 (*nom. tant.*); id. in Journ. Linn. Soc., Bot., 49, 1932, p. 87; FILARSZKY in Arch. Hydrob. 1934, Suppl. Bd. 12, Trop. Binnengew. Bd. 4, p. 724; MUKERJI in Proc. 21st Ind. Sci. Cong., Bombay, 1934, p. 295; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, p. 17 — ? *Chara setigera* KLEIN in herb. WILLDENOW 1796 (*cum descriptione*) — ? *Chara setosa* KLEIN ex WILLDENOW in Samml. d. Abh. Kön. Ak. Wiss. Berlin, 1806, p. 58; id. in Spec. Plant. 4, 1805, p. 184, *pro parte*; PERSOON, Synops. Plant., 1807, p. 530; AGARDH, Syst. Alg., 1824, p. 130; BRUZELIUS & FUERNROHR in Flora 9, 1826, p. 490 — *Chara brachypus* A. BR. α *setigera* KUETZING, Spec. Alg., 1849, p. 522 — *Chara brachypus* A. BR. β *nubica* KUETZING, Spec. Alg., 1849, p. 522; WALLMAN, Act. Soc. Linn. Bordeaux 21, 1856, p. 58.

Illustrations. WILLDENOW in Samml. d. Abh. Kön. Ak. Wiss. Berlin, 1806, pl. 1, f. 1; KUETZING, Tab. Phyc. 7, 1857, pl. 57, f. 2; G. O. ALLEN in Journ. Bomb. Nat. Hist. Soc. 30, 1925, pl. 1, f. 1; id. in Journ. Ind. Bot. Soc. 7, 1928, f. 12; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, pl. 9, f. 2; the pres. paper, figs. 15*a*—*d*.

Plant monoecious, greyish green, slightly incrusted, very brittle, c. 20 cm high. *Stem* rather slender, up to 600 μ in diam. *Internodes* as long as or somewhat longer than the branchlets. *Cortex* triplostichous, primary cortical-cells equally developed as the secondary ones. *Spine-cells* rather frequent, short, solitary, especially developed on young branchlets, up to 60 μ long. *Stipulodes* in a double whorl, twice as numerous as the branchlets, the cells of the lower whorl usually very short, c. 225 μ long, c. 100 μ wide, those of the upper row 600 μ long, c. 60 μ wide, acute, somewhat incurved. *Branchlets* 9—12 in a whorl, consisting of 5—8 articulations, the lowest articulation shorter than the stipulodes, colourless and hidden behind them, consequently triple-corticate. *Bract-cells* 6—8, posterior pair reduced to papillae or wanting, on fertile nodes c. 500 μ long, c. 45 μ wide; on sterile nodes 225 μ long, 75 μ wide. Terminal branchlet-articulation very

short, penultimate one long. *Bracteoles* similar to but longer than the anterior bract-cells, somewhat shorter than or as long as the oogonia. ♂ and ♀ *gametangia* at the three lowest nodes, solitary, at the same nodes. *Antheridia* 310—390 μ in diam., earlier ripe than oogonia. *Oogonia* 710—795 μ long (incl. coronula), 600—650 μ wide; *spiral-cells* showing 13—15 convolutions; *coronula* 115 μ high, c. 250 μ wide at base, individual cells rather short and blunt, connivent, or a little converging; *oospores* black, 560—760 μ long, 500—595 μ wide, with 12--13 ridges.

INDIA: Assam, without date and collector's name, herb. HOOKER 1867 (K).

INDO-CHINA: Tonkin, central part, Kiên Khê, in the river Dông, 19 X 1883, BON 2306 (P).

JAVA: Bantam, Tjipining, V 1934, no collector's name (Bz).

BALI: S. Bali, Danoe Batoer, caldera lake of the G. Batoer, depth 1.5 m, 1031 m alt., 21 VI 1929, German Limnol. Sunda Exp. BB3c (Bu-Mus).

NEW GUINEA: Territory of N. G., K. Wilhelmsland, Kélana, 28 VI 1888, KÖRNBACH s.n. (B, K, S).

Vernacular name: Rong = Fucus (Tonkin).

Remarks. *Chara brachypus* very much resembles *C. inermis* from which it is at once distinguished by the presence of spine-cells, the rudimentary stipulodes and the larger gametangia. The triplostichous *C. Handae* has ecorticate branchlets whereas in *C. brachypus* they are double corticate. *C. infirma* is dioecious. The species still more resembles *C. zeylanica*, from which it is distinguishable by examination of the lowest branchlet-articulation, which in *C. brachybus* is corticated.

These cortical-cells of the lowest articulation are often overlooked on account of their transparency, as is recently shown by FILARSZKY (1934, p. 724), who writes: "ein äusserst kurzes unberindetes Basalglied"; and the same is found in BRAUN's notes to his type description (1849, p. 298), where he writes: "... among which the shortness of the first joint of the leaves, which is uncovered and hidden beneath the stipulae...". However, this is most probably a misprint and has to read "uncoloured", as on the following page BRAUN says, on quoting the differences between *C. brachypus* and other species: "But in *C. polyphylla* the first joint of the leaf is not only uncoloured, but also uncovered and therefore not striated". G. O. ALLEN (1928, p. 65) supposes that the pale colour of this lowest articulation is due to its not taking up lime, as is also the case in the coronula-cells, reason why the latter cells are never found fossilized. I do not know the plant in a living state, nor whether chlorophyll is extant in the cells mentioned.

In the synonyms I put an interrogation-mark before the names of *C. setigera* and *C. setosa* because I have not seen any specimens of these. It is still doubtful whether the oldest name is *brachypus* or *setosa* under which the species was first published by WILLDENOW, and under which it was recognized by the authors up to 1849. However, according to BRAUN (1849, p. 299) the authors of *C. setosa* did not know exactly their own species, and confounded it with *C. zeylanica* as can be stated on comparing WILLDENOW's herbarium. Without absolute certainty it seems better to emphasize this question rather than changing an once accepted name.

BRAUN has distinguished two varieties, viz. *gracilescens* (1849, p. 298) and *Ehrenbergiana* (1867, p. 230; 1868, p. 867) occurring near Madras and in Egypt respectively. Var. *gracilescens* is probably a slender form with less than 8—9 branchlets, inconspicuous spine-cells, whereas the uncoloured lowest articulation is longer than the stipulodes. Var. *Ehrenbergiana* is somewhat aberrant as the branchlets in the lower whorls and in some of the upper ones are entirely ecorticate. Most probably it is a monstrosity.

Ecology. *Chara brachypus* is a moderately stout plant with a greyish green colour due to the lime incrustation. It occurs in shallow drains and slightly flooded fields. In Bali it was collected at a depth of 1.5 m in a caldera lake with a total depth of 90 m. From this locality some other data may be taken from the label, viz. surface temperature 22.7° C., alkalinity $5.80 \cdot 10^{-4}$, Cl-content 209 mg per l, pH 8.5.

It has most probably no preference for lowland or mountainous areas. The bottom must be solid, for G. O. ALLEN (1928, p. 65) remarks that he never found it growing in soft mud.

In India the seasonal distribution ranges from August to November according to PAL (1932, p. 51), whereas ALLEN (1928, p. 66) records ripe oospores in Saharanpur from July to December; in Malaysia they are found in May and June.

C. brachypus occurs very frequently together with other *Charophyta*, i.e. *C. burmanica*, *C. Grovesii*, *C. Handae* and *C. fibrosa* ssp. *flaccida*. Recorded as epiphytes are species of *Oedogonium*.

Distribution. Between 31° N. and 15° S.; ASIA, India: Assam; Indo-China; Java; Bali; New Guinea. Moreover in lit.: India: W. Himalaya, MUKERJI (1931, p. 206); India Deserta, Malabaria, GROVES (1924, p. 375), DIXIT (1931, p. 206), Coromandelia, BRAUN (1849, p. 298), GROVES (1924, p. 375), Gangetic Plain, BRAUN

& NORDSTEDT (1882, p. 185), GROVES (1924, p. 375), GROVES & ALLEN (1927, p. 339), ALLEN (1928, p. 65), ? AGHARKAR & KUNDU (1937, p. 18), Burma, PAL (1932, p. 87); Malaysia: Timor, NORDSTEDT (1889), p. 8), DE WILDEMAN (1899, p. 96), ? Philippine Islands, GROVES (1912, p. 70) — AFRICA, N. Afr.: Egypt, Egyptian Sudan, BRAUN (1868, p. 868); KUETZING (1849, p. 522); S. Afr.: Angola, BRAUN (1868, p. 868); Madagascar, GROVES (1927, p. 135), ZANEVELD (1939, p. 382) — AUSTRALIA, N. Austr.: ex GROVES (1924, p. 375).

3. GYMNOBASALIA ZANEV., nov. nom. — *Gymnopodes* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 203; id., id., p. 299; id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 800, 1868; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 23; T. F. ALLEN, Charac. America 1, 1888, p. 62; NORDSTEDT in Proc. Roy. Soc. Vict. 31, N. S., 1918, p. 6; J. GROVES in Journ. Linn. Soc., Bot., 46, 1924, p. 375; PRINTZ in ENGLER & PRANTL, Nat. Pfl. fam. 3, ed. 2, 1927, p. 429; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, p. 59; ZANEVELD in Blumea 3, 1939, p. 381.

Lowest articulation of the branchlets destitute of cortical-cells.

Remarks. The alteration of the name of this series was necessary as BRAUN's name duplicates one earlier given to a series of the *Haplostephanae*.

25. **Chara zeylanica** WILLDENOW in Mém. Ac. Roy. Berlin p. 1803, p. 86, 1805; id. in Samml. d. Abh. Kön. Akad. Wiss. Berlin f. 1803, p. 59, 1806 — *Chara armata*; *C. armata* var. *diaphana*; *C. ceylanica*; *C. ceylonica*; *C. foliolosa*; *C. gymnopus*; *C. gymnopus* var. *ceylonica*, var. *armata*, var. *armata* f. *paragymnophylla*; *C. haitensis*; *C. polyphylla*; *C. polyphylla* var. *ceylonica*, var. *Meyenii*, var. *Meyenii* f. *paragymnophylla*; *C. variabilis*; *C. zeylonica*; *Conferva littoralis*; cf. formae.

Plant monoecious, greyish to brownish green, frequently heavy impregnated with lime, up to 25 cm high (sometimes more). *Stem* stout, 600—800 μ in diam. *Internodes* 0.5—3 times as long as the branchlets. *Cortex* triplostichous, primary cortical cell-series equally developed as the secondary. *Spine-cells* numerous, varying in length from 60 to 700 μ, acute, c. 90 μ wide, especially developed just above and below a stem-node. *Stipulodes* in a double whorl, twice as numerous as the branchlets, acute, exceeding the lowest branchlet-articulation in length, c. 900 μ long, 90—105 μ wide at base. *Branchlets* 11—14 in a whorl, composed of 8—13 articulations, the short lowest and usually 1—3 ultimate articulations ecorticate (cf. f. *armata* and f. *diaphana*), all

other ones triply corticated. *Bract-cells* 6—8 (usually 6), anterior pair 1—3 times the length of the oogonium, posterior ones usually half as long as the oogonium; apices of the bract-cells usually incrusted, therefore they seem to be blunt. *Bracteoles* similar to the anterior bract-cells, but longer. ♂ and ♀ *gametangia* most frequently only produced at the nodes of the corticated articulations, solitary at the same nodes. *Antheridia* 400—500 μ in diam., enveloped in four shields. *Oogonia* 760—950 μ (incl. coronula), 440—560 μ wide; *spiral-cells* showing 12—15 convolutions; *coronula* 95—134 μ high, 170—230 μ wide at base, individual cells ovate, spreading at the apex; *oospores* black, 650—710 μ long, 320—350 μ wide, with 10—12 small ridges.

Remarks. The tropical species *par excellence*, *Chara zeylanica*, is one of the most variable species as is already pointed out by several authors. Specimens which vary but slightly from the type are either described as forms (Braun & Nordstedt, 1882, pp. 189—199) or they are considered as species (Robinson, 1906, pp. 282—295). When more material was collected, more transitional stages became evident. Therefore, H. & J. Groves (1911, p. 41) did not maintain the 14 species of Robinson, but accepted for the West-Indies 9 forms, for which they state that nearly all the specimens appeared to be more or less intermediate and rarely agree exactly with any of the named forms.

This extreme variability of this species has lately led Filarszky (1934, p. 721) to the establishment of a new species, *C. variabilis*. This name at the same time expresses very well the extraordinary variability, however, after studying his specimens it appears that not one single feature asserts, on account of which the plants could be considered a separate species.

The Malaysian exsiccatae are macroscopically readily separable into two groups, the one with a long slender habit, the other with a more compact appearence. The plants of the former group have the branchlets, spine-cells and bract-cells rather short, i. e. not visible to the naked eye (forma *typica*), whereas the plants of the other group have long branchlets, spine-cells and bract-cells, which are macroscopically visible (f. *armata* and *diaphana*).

Chara zeylanica is the only member of the *Triplostichae* which

Fig. 19, *Chara fibrosa* ssp. *Benthamii*; *a*. habit, nat. size; *b*. stem-node with part of fertile branchlet, × c. 15 — Fig. 20, *Chara inermis*, n. sp.; *a*. habit, nat. size; *b*. stem-node, × c. 26; *c*. fertile branchlet-node, × c. 30; *d*. apex of branchlet, × c. 34 — Fig. 21, *Chara zeylanica* f. *typica*, n. f.; *a*. habit, nat. size; *b*. stem-node, × c. 16; *c*. fertile branchlet-node, × c. 18; *d*. apex of branchlet, × c. 21.


21b
19a
21d
21c
19b
20d
20b
21a
C MULDER DEL.
20a
20c

has the lowest branchlet-articulation ecorticate and by this feature it cannot be confused with any other *Chara*, except perhaps *C. javanica*, described by BRAUN (1849, p. 300), whereas WALLMAN (1856, p. 57) has taken over this description. However, the description of the last-named species is insufficient for an exact determination and the specimen has probably not been preserved. Afterwards it has been mentioned by WALLMAN (1856, p. 57), however, without a sufficient description. I think it probably a form of *C. zeylanica*.

Another characteristic, as far as we know specific for *C. zeylanica*, is that the antheridium is enveloped in four shield-cells instead of eight as is the case in all other *Charophyta* (cf. GROVES, 1931, p. 97).

I have followed GROVES (1898, p. 323) in using WILLDENOW's name *zeylanica* for this species. However, there is some doubt whether this name or that of *C. foliolosa* is valid. Both names are published by WILLDENOW at the same time (1805, p. 86), but that of *C. foliosa* is mentioned first. Neither BRAUN's names *C. gymnopus* (1868, p. 70; published as a *nomen nudum* in 1847, p. 23), nor his *C. polyphylla* (1835, p. 70) especially used by himself and by the authors of the 19th century, is validly published as is clear from his own explanation in 1858 (pp. 361—362). BRAUN regarded *C. foliolosa* as a variety of *C. polyphylla* (1849, p. 300), whereas GROVES (1911, p. 40) cited it as a synonym of *C. zeylanica*. As I did not see the type specimens I cannot give a decision just now.

E c o l o g y. *Chara zeylanica* is a robust species occurring in almost all types of fresh water in the tropics and subtropics. It is therefore found in lakes, ponds, moats, jhils, rice-fields, pools, etc., though the water may also be brackish as is shown by the Java specimens collected by SUNIER, whereas DIXIT (1931, p. 206) found it in saline waters of Salsette, containing c. 2.5 % NaCl and SENIOR-WHITE (1926) in a drain with c. 3.3 % NaCl.

It is, as a rule, heavily incrusted with lime, which is sometimes annular in character. The species is not found at great altitudes, but according to its cosmopolitan character it may be found in the lowlands as well as in the mountainous regions.

Concerning the particulars of the environment there is only one note, viz. on a label of the Sumatra plants from lake Singkarak. This lake measures c. 108 km², 21 km long, 7 km wide, 269 m deep, 360 m alt., temperature of the surface 27—28° C., pH 8.7, alkalinity $1.6 . 10^{-4}$.

As to the seasonal distribution I may remark that it is found

in India from September to December (PAL, 1932, p. 51; ALLEN, 1925, pl. 5; 1928, p. 66). According to ALLEN (1925, p. 599) it prefers in Gonda the rainy season, as it was found in great masses at the end of the rains but no signs of it later. In Malaysia it is found all the year round, December and January excepted.

As epiphytes are quoted *Rivularia dura* and *Gleotricha pisum* (DIXIT, 1931, p. 206).

Distribution.[1]) Between 50° N. and 23° S.; ASIA, India; Siam; Malay Peninsula; Malaysia; Andaman Islands — AUSTRALIA; New Caledonia; Hawaiian Islands; cf. formae. Moreover in lit.: AMERICA, N. Am.: United States, T. F. ALLEN (1872, p. 10; 1894, p. 164), BRAUN & NORDSTEDT (1882, pp. 190, 191, 195, 197), ROBINSON (1906, pp. 286, 287, 290, 295, 296); Texas, BRAUN (1858, p. 363), BRAUN & NORDSTEDT (1882, pp. 190, 194—196), ROBINSON (1906, p. 295); C. Am.: Mexico, BRAUN (1858, p. 363), BRAUN & NORDSTEDT (1882, pp. 194, 196, 197), T. F. ALLEN (1894, p. 164), ROBINSON (1906, p. 287, 289); Guatemala, BRAUN & NORDSTEDT (1882, p. 195), NORDSTEDT (1888, pp. 192, 193), ROBINSON (1906, p. 287); Nicaragua, BRAUN & NORDSTEDT (1882, p. 193); Bermuda Islands, NORDSTEDT (1889, p. 40), GROVES (1911, p. 43), BRITTON (1918, p. 504); Bahama Islands, T. F. ALLEN (1894, p. 167), GROVES (1911, p. 43); Greater Antilles, BRAUN & NORDSTEDT (1882, p. 195), NORDSTEDT (1888, pp. 192, 194), T. F. ALLEN (1894, p. 163), ROBINSON (1906, pp. 283, 292), GROVES (1911, p. 43); Lesser Antilles, BRAUN & NORDSTEDT (1882, pp. 194, 195, 198), ROBINSON (1906, p. 285), GROVES (1898, p. 324; 1911, pp. 43, 44); S. Am.: Venezuela, BRAUN (1858, p. 360), BRAUN & NORDSTEDT (1882, pp. 194—196), ROBINSON (1906, p. 293) — AFRICA, N. Afr.: Egypt, BRAUN (1868, p. 870), BRAUN & NORDSTEDT (1882, pp. 189, 191); Somaliland, BRAUN & NORDSTEDT (1882, p. 196); S. Afr.: Angola, BRAUN (1868, p. 871); Mauritius, Réunion, BRAUN (1868, p. 872), Madagascar, BRAUN (1868, p. 872), GROVES (1927, p. 136), ZANEVELD (1939, p. 199).

f. 1. **typica** ZANEV., nov. form. — *Chara zeylanica* WILLDENOW in Mém. Ac. Roy. Berlin p. 1803, p. 86, 1805; id. in Samml. d. Abh. Kön. Ak. Wiss. Berlin f. 1803, p. 59, 1806; id., Spec. Plant. 4, 1805, p. 184; PERSOON, Syn. Plant. 2, 1807, p. 530; AGARDH, Syst. Alg., 1824, p. 128; BRUZELIUS & FUERNROHR in Flora 9, 1826, p. 486; KUETZING, Tab. Phyc. 7, 1857, p. 302; H. & J. GROVES in Journ. Linn. Soc., Bot., 33, 1897, p. 323; id. in URBAN, Flor. Ind. Occ. 7, 1911, p. 40; id. in Philipp. Journ. Sci. 7,

[1]) For extensive literature quotations, cf. the formae.

1912, p. 70; MERRILL, Spec. Blancoanae, 1918, p. 39; J. GROVES in Journ. Linn. Soc., Bot., 46, 1922, p. 102; id. in Journ. Linn. Soc., Bot., 46, 1924, pp. 363, 375; G. O. ALLEN in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 597; GROVES & ALLEN in Journ. Bot. 65, 1927, p. 339; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, p. 65; J. GROVES in Journ. Linn. Soc., Bot., 48, 1928, p. 136; PAL in Journ. Burma Res. Soc. 18, 3, 1929, p. 113 (*nom. tant.*); DIXIT in Journ. Ind. Bot. Soc. 10, 1931, p. 206; PAL in Journ. Linn. Soc., Bot., 49, 1932, pp. 65, 88; MUKERJI in Proc. 21st Ind. Sci. Congr., Bombay, 1934, p. 295; DIXIT in Journ. Ind. Bot. Soc. 14, 1935, p. 262; GROVES & ALLEN in Proc. Roy. Soc. Queensl. 46, 1935, pp. 42, 59; AGHARKAR & KUNDU in Journ. Dep. Sci., N. S. 1, 1937, pp. 11, 18; ZANEVELD in Blumea 3, 1939, pp. 381—382 — *Chara foliolosa* MÜHLENB. ex WILLDENOW in Mém. Ac. Roy. Berlin p. 1803, p. 86, 1805; id. in Samml. d. Abh. Kön. Ak. Wiss. Berlin f. 1803, p. 58, 1806; id., Spec. Plant. 4, 1805, p. 184 — *Chara haitensis* TURPIN in Dict. Sci. Nat., 1826, Veg. Acot. p. 101; FILARSZKY in Arch. Hydrobiol. 1934, Suppl. Bd. 12, Trop. Binnengew. Bd. 4, p. 725 — *Chara verticillata* ROXBURGH, Fl. Ind. 3, 1832, p. 563; HATE in Journ. Bomb. Nat. Hist. Soc. 19, 1909, p. 762 (as *verticulata*) — *Chara polyphylla* A. BRAUN in Regensb. Bot. Zeit. 1, 1835, p. 70 *p.p.*; id. in HOOKER's Journ. Bot. 1, 1849, p. 299 — *Chara polyphylla* var. *ceylonica* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 300 — *Chara zeylonica* WILLD., KUETZING, Spec. Alg., 1849, p. 522 — *Chara gymnopus* A. BRAUN in N. Denkschr. Schw. Ges. Naturw. 10, 1849, p. 23 (*nom. tant.*); id. in Monatsber. Kön. Akad. Wiss. Berlin f. 1867, p. 870, 1868, *pro parte* — *Chara ceylonica* (KLEIN) WILLD., WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 56 — *Chara ceylanica* WILLD., BRAUN in MARTENS' Die Preuss. Exp. n. O.-Asien, Bot. Th., 1866, p. 143 — *Chara gymnopus* A. BR. var. *ceylonica* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 197; T. F. ALLEN, Charac. Americ. 1, 1888, p. 63 (*nom. tant.*); NORDSTEDT in Lunds Univers. Års-skr. 25, 1889, p. 40; NORDSTEDT in Forschungsreise S. M. S. "Gazelle", 1889, p. 8; DE WILDEMAN, Prodr. Flor. Algol. Ind. Néerl., 1897, p. 30; id., Suppl. et Tabl. Stat., 1899, p. 98; id., Alg. Fl. Buitenz., 1900, p. 374; BAILEY, Compreh. Catal. Queensl. Plants, 1909, p. 682; NORDSTEDT in Proc. Roy. Soc. Vict., N. S. 31, 1918, p. 6 (*nom. tant.*).

Illustrations. WILLDENOW in Mém. Ac. Roy. Berlin p. 1803, pl. 2, f. 1, 1805; id. in Samml. d. Abh. Kön. Ak. Wiss. Berlin f. 1803, pl. 2, f. 1, 1806; KUETZING, Tab. Phyc. 7, 1857, pl. 76, f. 1; G. O. ALLEN in Journ. Ind. Bot. Soc. 7, 1928, f. 13; AGHARKAR & KUNDU in

Journ. Dep. Sci., N. S. 1, 1937, pl. 9, f. 3; the pres. paper, figs. 21*a*—*d*.

Planta grandis, tenuis, elongata. *Internodia* quam ramuli duplex longiora. *Spinulae* paucae, ¼ quam diameter caulis longiores. *Verticillorum ramuli* 11—12, erecti, c. 1.5—4 cm longi, articulationes 7—14, quarum 6—10 corticatae, 1—4 ecorticatae. Nodi inferiores steriles. *Oosporae* c. 700 μ longae.

Plant large but slender. *Internodes* 2 times as long (and sometimes more) as the branchlets. *Spine-cells* short, acute, cone-like, rather few, ¼ as long as the diam. of the stem, not visible with the naked eye. *Branchlets* straight, 11—12 in a whorl, 1.5—4 cm long, with 6—10 corticate articulations and 1—4 ecorticate ones, the ecorticate lowest articulation excepted, which is thrice as long as wide. First branchlet-node sterile. *Oospores* usually 700 μ long.

SIAM: Pak Raw, inside channel between two parts of Talé Sap (water 4—6 m, brackish), 25 I 1916, ANNANDALE 15 (Si), together with *Chara corallina* and *C. hydropitys*.

SUMATRA: Tapanoeli, Perapat, in a quiet bight of Lake Toba, rooting at a depth of 2 m, alt. c. 906 m, 27 V 1923, LÖRZING 10115b (Bz), badly preserved sterile fragments, therefore not to be identified with certainty; ibid., Lake Toba, at the border of Samosir Isl., from 12 m depth, 12 IV 1929, German Limn. Sunda Exp. TH1a (Bu-Mus).

JAVA: Priangan, Sitoe Bagendit, without date, and collector's name (L), two robust specimens; ibid., near Garoet, in a lake, 11 II 1894, VON SCHIFFNER s.n., Iter indicum 1893—'94 (L), 4 robust sterile specimens, therefore identification not certain.

BALI: S. Bali, near Bangli, in the lake Danoe Batoer, 973 m alt., 8 IX 1857, ZOLLINGER 3386 ? (L), det. A. BRAUN as "*N. Zollingeri* BR.".

KAI ISLANDS: Ohoitiel near Toeal, floating in the lake, 2 V 1922, Danish Exp. to the Kai Islands 1922, JENSEN 297 (Bz, L), sterile specimens.

Remarks. The plants belonging to this form are macroscopically characterized by the large, but slender habit with long branchlets and internodes. They do not possess macroscopically visible spine-cells and are thereby distinguishable from f. *armata*. As the discrimination of these two forms is not always taken into account, the distribution must of necessity be incomplete.

Distribution. Between 35° N. and 20° S.; ASIA, Siam; Malaysia: Sumatra; Java; Bali; Kai Islands. Moreover in lit.: India: W. Himalaya, MUKERJI (1934, p. 295); Malabaria, WILLDENOW (1805, p. 84), DIXIT (1931, p. 206; 1935, p. 262); Coromandelia, BRAUN (1849, p. 300), BRAUN & NORDSTEDT (1882, p. 197); Ceylon, WILLDENOW (1805, p. 184), BRAUN & NORDSTEDT (1882, p. 197), GROVES (1922, p. 102); Gangetic Plain, BRAUN (1849, p. 300), ALLEN (1925, p. 597; 1928, p. 65), GROVES & ALLEN (1927, p. 339); Assam; Andaman Islands;

Malaysia: Malay Peninsula, GROVES (1924, p. 375); Bali, BRAUN & NORDSTEDT (1882, p. 197), DE WILDEMAN (1897, p. 30); Cocos Islands, GROVES (1924, p. 375) — AUSTRALIA, N.W. Austr.: NORDSTEDT (1889, p. 8); N. Territory, Victoria River, BRAUN & NORDSTEDT (1882, p. 197); Queensland, Mitchell River, Carpentaria, NORDSTEDT (1889, p. 59), BAILEY (1909, p. 682), GROVES & ALLEN (1935, p. 59).

f. 2. **armata** (MEYEN) ZANEV., nov. comb. — *Chara armata* MEYEN, Reise um die Erde 2, 1835, p. 131; KUETZING, Tab. Phyc. 7, 1857, p. 30 — *Conferva littoralis* BLANCO, Flor. Filip., 1837, p. 843; id., ed. 2, 1845, p. 582; id., ed. 3, 3, 1879, p. 263 — *Chara polyphylla* A. BR. var. *Meyenii* A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 300; WALLMAN in Act. Soc. Linn. Bordeaux 21, 1856, p. 57 — *Chara gymnopus* A. BR. var. *armata* (MEYEN) NORDSTEDT in Physiogr. Sällskap. Minesskr., 1878, p. 23; BRAUN & NORDSTEDT in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 191; T. F. ALLEN, Charac. America 1, 1888, p. 63 (*nom. tant.*); LAMMERMANN in ENGLER's Bot. Jahrb. 34, 1905, p. 635; MACCAUGHEY, Alg. Hawaiian Arch. 2, Bot. Gazette 65, 1918, p. 136 — *Chara variabilis* FILARSZKY in Arch. Hydrobiol. 1934, Suppl. Bd. 12, Trop. Binnengew. Bd. 4, p. 721; id. in Math. u. Naturw. Anz. Ung. Akad. Wiss. 52, 1935, p. 468 (*nom. tant.*).

Illustrations. KUETZING, Tab. Phyc. 7, 1857, pl. 75, f. 1; FILARSZKY in Arch. Hydrobiol. 1934, Suppl. Bd. 12, Trop. Binnengew. Bd. 4, figs. 75—80.

Plants more compact than f. *typica*. *Internodes* 1.5 times the length of the branchlets. *Spine-cells* long, acute, very frequent, up to as long as the diam. of the stem. *Branchlets* 10—12 in a whorl, rigid, with 5—10 corticated articulations and 1—4 ecorticate ones; the ecorticate lowest articulation is 3—5 times as long as the diam. The lowest branchlet-node is sterile. *Oospores* usually 700 μ long.

INDIA: Coromandelia, Pondichery, no date, PERROTTET 610, herb. HASSKARL in (L).

SUMATRA: Atjeh, Takengon, in Laoet Tawar, 1180 m alt., 30 VIII 1934, VAN STEENIS 6063 (Bz), sterile; Tapanoeli, Batakdistr., Lake Toba, 16 VII 1904, VAN DAALEN 539c (Bz, L); ibid., Lake Toba, Porsea Basin, south border from 4 m depth, 8 IV 1929, German Limnol. Sunda Exp. TP1c (Bu-Mus), *type* of *C. variabilis* FILARSZKY; West Coast, Padangse Bovenlanden, Lake Singkarak, 6 III 1929, 2 specimens floating on the surface near the W. border, 4 specimens from a depth of 50—70 cm, 2 specimens from the W. border near Panjingahan from 1—1.5 m depth, 16 III 1929, German Limnol. Sunda Exped. Sk4e and Sk4 (Bu-Mus), cotype of *C. variabilis* FILARSZKY.

JAVA: Batavia, Tjilintjing, in a marine fishpond, 26 V 1922, SUNIER s.n. (Bz, L).

PHILIPPINE ISLANDS: Luzon, Manila, in pools, XI 1914, MERRILL, Species Blancoanae 180 (Bz, K, L).

NEW CALEDONIA: without exact locality, 1868—1870, BALANSA 1551 (P).

Remarks. Forma *armata* is at once recognizable by the short, straight branchlets with the long bract-cells and by the long spine-cells, already visible with the naked eye. KUETZING's figure (1857, pl. 75) of the habit is very striking. Plants with more than four naked articulations are to be inserted in the f. *diaphana*.

The reasons why I have not accepted FILARSZKY's new species *C. variabilis* are pointed out on p. 204.

Distribution. Between 13° N. and 23° S.; ASIA, India; Malaysia: Sumatra, Java, Philippine Islands — AUSTRALIA, New Caledonia, MERRILL (1918, pp. 39, 40), GROVES (1912, p. 70).

f. 3. **diaphana** (MEYEN) ZANEV., nov. comb. — *Chara armata* MEYEN var. *diaphana* MEYEN, Reise um die Erde 2, 1835, p. 131; KUETZING, Tab. phyc. 7, 1857, p. 30 — *Chara polyphylla* A. BR. var. *Meyenii* A. BR. f. *paragymnophylla* A. BR. in HOOKER's Journ. Bot. 1, 1849, p. 300 — *Chara gymnopus* A. BR. var. *armata* (MEYEN) NORDST. f. *paragymnophylla* A. BRAUN in Abh. Kön. Akad. Wiss. Berlin 1882, p. 191.

Illustrations. KUETZING, Tab. Phyc. 7, 1857, pl. 75, f. 2.

Differs from f. *armata* only by having more than four ecorticate branchlet-articulations. The same branchlet-whorl contains sometimes also entirely ecorticate branchlets. This particular is very well shown in KUETZING's figure. Another characteristic is the fertility of the lowest branchlet-node.

BALI: Soember Klampok, in desiccating pools surrounded by *Excoecaria*, 21 VII 1934, DE VOOGD 2175 (Bz).

HAWAIIAN (SANDWICHES) ISLANDS: without further particulars [but most probably collected in Oahu by MEYEN, V 1831, cf. *C. Braunii* var. *oahuensis*], (L), fragment of the *type*; ibid., IV 1883, BAILEY s.n. [T. F. ALLEN, Charac. Americ. Exsicc. 40], (L), badly preserved specimens; Oahu, in lower Panuoa, 4 VI 1895, HELLER, Plants of the Hawaiian islands 2386 (L).

Remarks. The above cited plants differ but slightly from the f. *armata*, but the branchlets have more ecorticate articulations and the lowest node is fertile. These characteristics suffice to consider the plants representing a form but not a variety as MEYEN did.

The plants from Bali were treated with sublimate, they have therefore a somewhat unusual appearance; the plants are entirely subdiaphanous.

Distribution. Between 22° N. and 7° S.; ASIA, Malaysia: Bali — Hawaiian Islands.

Doubtful and little-known species and varieties.

Nitella fascicularis FILARSZKY et G. O. ALLEN in Math. Naturw. Anz. Ung. Akad. Wiss., Budapest 55, 1937, p. 478, figs. 6—12. Recorded from Kuala Lumpur, Malay Peninsula. Probably belonging to the dioecious *Homoeoclemae-Bicellulatae*; cf. p. 9.

Nitella tenuissima (DESV.) KUETZ. var. **byssoides** A. BRAUN in Abh. Kön. Akad. Wiss. Berlin, 1882, p. 64. First described by BRAUN (1849, p. 294) as *Nitella byssoides* from the Coast of Coromandel; cf. p. 99.

Chara foetida and **Chara spinalis** ex herbarium HAMILTON. Collected in Bangsi, Malay Peninsula; quoted without further comment in WALLICH's "Catalogue" (1928, p. 181) under Nos. 5190 and 5188 respectively and again by BRAUN (1849, p. 301).

Chara fulgens FILARSZKY in Arch. f. Hydrobiol. 1934, Suppl. Bd. 12, Trop. Binnengew. Bd. 4, p. 720. Recorded from Bali; cf. p. 136.

Chara hispida ex herbarium Madras. Mentioned without locality or other particulars by WALLICH in his "Catalogue" under No. 5189 and by BRAUN (*l. c.*, p. 301).

Chara javanica A. BRAUN in HOOKER's Journ. Bot. 1, 1849, p. 300; WALLMAN in Bull. Soc. Linn. Bordeaux 21, 1856, p. 57; T. F. ALLEN in Bull. Torrey Bot. Cl. 7, 1880, p. 107 (*nom. tant.*). Recorded from Java; cf. p. 5.

Chara polyclados DON. Cited by BRAUN (1849, p. 301) only as a *nomen tantum* with the remark "ubinam descripta?" and supposed to occur in the area dealt with in the present paper.

Chara soluta GRIFFITH, Not. Pl. Asiat. 2, 1849, p. 280. Probably collected in Hurdwar (= Haredwara, India Deserta). The species is insufficiently described and has never been mentioned again, whereas the type specimen seems to have disappeared.

Index to collectors' numbers,

with reference to the pages by means of the numbers in parentheses.
s.n.: unnumbered specimens.

Index to scientific names.

New names and new combinations in **boldface** type; synonyms in *italics*; accepted genera in CAPITALS; page numbers indicating the most important mention in italics; an asterisk before a page number denotes a figure.

B L U M E A

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QUELQUES OBSERVATIONS SUR LES BRYOPSIS DU GOLFE DE NAPLES

par

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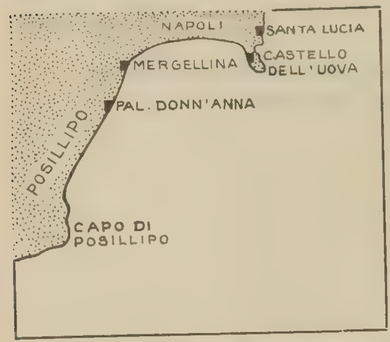
(Issued February 8th, 1941)

1. INTRODUCTION.

Evidemment la flore algologique du Golfe de Naples a été étudiée, d'assez près, tant du point de vue floristique que du point de vue écologique. Surtout FALKENBERG (1879), BERTHOLD (1882) et FUNK (1927) se sont occupés des investigations de cette nature. Il reste cependant un certain nombre de genres, qui demandent une étude plus approfondie. Un de ces genres est sans aucun doute *Bryopsis* pour laquelle il est difficile de limiter les espèces à cause de leur grande variabilité. Voici comment HAMEL (1930) se prononce sur ce genre: «D'ailleurs, les *Bryopsis* méditerranéens sont loin d'être connus; le peu que nous en savons est dû aux observations de J. Agardh; toute leur étude serait à reprendre sur le vivant.» FELDMANN (1937) y ajoute: «La classification des *Bryopsis* est encore bien confuse. La grande variabilité de ces algues et le peu de secours que peuvent fournir à l'étude les échantillons d'herbier rendent leur détermination très malaisée.» La Station zoologique à Naples, grâce à la table de travail néerlandaise, a fourni une belle occasion d'observer les *Bryopsis* vivants et dans leur habitats. L'étude de l'influence écologique des habitats a été rendue possible grâce à l'aide du pêcheur de la Station, rameur habile et guide parfait. Vu la variabilité des espèces il importe de collectionner une grande quantité d'individus pour étudier la limitation des espèces et pour reconnaître des formes comme unités taxonomiques. En outre, pour se faire une idée exacte des formes existantes il était nécessaire de visiter autant d'habitats que possible.

sans négliger les habitats voisins. Les conditions écologiques ont été étudiées autant que possible sur les lieux mêmes. Finalement les épiphytes des *Bryopsis* ont été déterminés, les *Diatomées* exceptées. Les observations suivantes ont été faites dans le Golfe intérieur de Naples du 17 avril au 1er juin 1939 pendant des journées assez calmes et à marée basse. Malheureusement le mauvais temps à la fin du séjour a empêché l'étude du Golfe extérieur.



Partie du Golfe de Naples entre Naples et Posillipo; 1: 120.000.

2. HABITATS.

Vingt-deux habitats ont été étudiés:

Habitat n° 1: Posillipo, Villa D'Ambra, ± 20 cm au-dessus du niveau de la mer, toujours arrosé, exposé au Sud-Est, sur tuf, dans eau limpide et assez agitée.

Ulva Lactuca L., *Cladophora albida* (Huds.) Kütz., *Porphyra leucosticta* Thur., *Pterocladia capillacea* (Gmelin) Born. et Thur., *Caulacanthus ustulatus* (Mert.) Kütz., *Gelidium pusillum* (Stackh.) Le Jol., *Ceramium rubrum* (Huds.) Ag., *Ceramium strictum* Grev. et Harv.

Bryopsis muscosa Lamour. (Fig. 1—12, 14, 18); plumules longs, étroits, obtus ou arrondis au sommet ou même presque applatis, longs de 5—15 mm; branches du premier ordre rarement avec des branches du deuxième ordre au sommet; axes principaux irrégulièrement dichotomiques, peut-être régénération après avoir été détruits par des *Gastéropodes*. Des rhizoides sont émis au-dessus de la base de l'axe principal à des endroits quelconques. Le *Bryopsis* forme une ceinture.

Habitat n° 2: Posillipo, Pensione Martinelli, un peu au-dessus du niveau de la mer, cependant toujours arrosé, exposé à l'Est, sur tuf, dans eau limpide et assez agitée.

Ulva Lactuca L., *Gigartina acicularis* (Wulf.) Lamour., *Gelidium pusillum* (Stackh.) Le Jol.; *Callithamnion tetragonum* (With.) Ag.

Bryopsis Balbisiana Lamour.; axes principaux généralement non-dichotomiques, longs, de longueur de 5—7 cm; quelques-uns avec des branches du premier ordre (longues de 1 mm) à l'extrémité supérieure (longue de 3—6 mm).

TABLE I

Geographical distribution of the Malaysian and Indian Charophyta (cf. Chapter II § 1)

Species / Regions	India and Ceylon	Siam	Indochina	Andaman and/or Nicobar Isl.	Malay peninsula	Natuna Islands	Sumatra	Java and/or Madura, [illegible] Isl.	Borneo	Celebes	Philippine Islands	Bali	Lombok	Soembawa	Soemba	Timor	Amboina	Kei Islands	New Guinea	Australia and/or Tasmania, N. Zeal., N. Cal., Fiji Isl.	Hawaiian Islands	Mascarene Islands	Asia (remaining part)	Europe	North Africa	South Africa and/or Madag., Mauritius, [illegible] Isl.	South America	Central America	North America
Nitella																													
1. — mira[illegible]	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	(+)	(+)	(+)	—	[illegible]
— — var. Bélangeri	+	—	—	—	—	—	—	+	—	—	+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. subglomerata	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	(+)	(+)	[illegible]
3. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4. — tuberculata	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6. — dualis	—	—	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7. — globulifera	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8. — Annandalei	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11. — pseudoflabellata	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12. — moniliformis	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13. — batrachosperma	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14. — dictyosperma	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19. — [illegible]	[illegible]	—	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — f. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — f. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20. — burmanica	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	+?
22. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23. — superba	(+)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	[illegible]	[illegible]	[illegible]	(+)	+	(+)	(+)	(+)	(+)	(+)
24. — mucronata	(+)	—	—	—	—	—	—	+	—	—	—	—	—	—	—	—	—	—	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	—
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	(+)	(+)
25. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26. — elegans	(+)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	—	—
27. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	(+)	[illegible]
28. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29. — Allenuda	—	—	—	—	—	—	—	+	—	—	—	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	(+)	+	(+)	(+)	(+)	(+)	(+)
30. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tolypella																													
1. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	(+)	—	(+)
2. — hispanica	(+)	[illegible]	[illegible]	[illegible]	—	—	—	—	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	(+)	(+)	—	—	(+)
Nitellopsis																													
1. — obtusa	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lychnothamnus																													
1. — [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chara																													
1. — [illegible]	[illegible]	[illegible]	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — — f. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — — f. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — — f. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — — f. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — — f. typica	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — — f. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — — f. simplicissima	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2. — Wallichii	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3. — corallina	[illegible]	[illegible]	[illegible]	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4. — fulgens	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5. — Braunii	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. Braunii	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — — f. typica	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — — f. sumatrensis	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. Kurzii	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — — f. typica	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — — f. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — — f. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6. — succincta	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7. — [illegible]	+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8. — nuda	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9. — fibrosa	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — ssp. Benthamii	(+)	—	—	—	+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — ssp. gymnopitys	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — — var. typica	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	(+)	+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — ssp. flaccida	+	[illegible]	[illegible]	[illegible]	[illegible]	—	+	+	+	+	+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10. — erythrogyna	+	—	(+?)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11. — burmanica	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12. — hydropitys	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. indica	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — — f. major	[illegible]	+	[illegible]	[illegible]	+	[illegible]	+	+	—	—	+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — — f. minor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — — f. gymnophylla	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13. — canescens	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14. — Grovesii	(+)	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	+	+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15. — contraria	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16. — vulgaris	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — ssp. eu-vulgaris	+	—	+	—	—	—	—	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	(+)	+	(+)	[illegible]	[illegible]	[illegible]	[illegible]
— — ssp. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17. — Handae	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18. — aspera	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19. — infirma	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20. — connivens	(+)	—	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21. — globularis	(+)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — var. capillacea	+	—	+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22. — delicatula	(+)	—	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23. — inermis	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	+	—	—	(+)	+	—	—	—	(+)	—	—	+	(+?)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24. — brachypus	+	[illegible]	+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	(+)	(+)	(+)	(+)	[illegible]
25. — zeylanica	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — f. typica	(+)	+	—	(+)	(+)	—	+	+	+	[illegible]	+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — f. armata	+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	+	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
— — f. diaphana	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

LEGENDA

+ specimen(s) examined by the writer; (+) specimen(s) mentioned in literature consulted by the writer; (+?) [illegible]

Bryopsis muscosa Lamour.; il y a deux formes: *1º* longue de 5 cm; plumules larges de 2 mm, longs de 15 mm, presque pointus au sommet; *2º* longue de 3—4 cm; plumules larges de 4 mm, longs de 3—7 mm, arrondis ou presque applatis au sommet. *Anomalie*: axes principaux avec des branches du premier ordre, qui portent des branches du deuxième ordre très courtes au sommet.

Bryopsis plumosa (Huds.) Ag. f. **penicillata** (Suhr) Koster (Fig. **2**—8, 9, 10, 11); très peu compact, axes principaux en petit nombre, longs de 2—6 cm; plumules larges de 5—15 mm, branches du premier ordre longues de 5—20 mm, nombreuses, serrées ou distantes de 2 mm, plus ou moins distiques, sur le même plan, quelquefois non-ramifiées, mais le plus souvent avec des branches du deuxième ordre distiques à l'extrémité supérieure (longue de ± 1 mm) sur le même plan ou bien émises en tous sens, longues de ± ½ mm, parfois un peu courbées vers l'axe principal. Quelquefois il y a quelques branches du deuxième ordre plus longues (jusqu'à 1½ mm de long) ou des cicatrices de branches tombées à la partie inférieure des branches du premier ordre. Très souvent il y a des rhizoides dichotomiques à la base des branches du premier ordre, qui se pressent parfois contre l'axe principal. Quelquefois des branches du premier ordre se détachent. Chromatophores ellipsoides à irrégulièrement allongés, quelquefois presque sphériques, longs de 5—28 μ, larges de 4—5 μ (Fig. **2**—12).

Epiphyte sur *Bryopsis muscosa*: *Entocladia viridis* Reinke.

Habitat nº 3: Posillipo, Villa da Luca, contre un mur, au niveau de la mer, exposé au Sud-Est, sur tuf, dans eau limpide et peu agitée.

Ulva Lactuca L., *Dictyota dichotoma* (Huds.) Lamour., *Nitophyllum punctatum* (Stackh.) Grev., *Pterocladia capillacea* (Gmelin) Born. et Thur., *Gigartina acicularis* (Wulf.) Lamour., *Gelidium pusillum* (Stackh.) Le Jol., *Rhodymenia palmetta* (Esp.) Grev.

Bryopsis Balbisiana Lamour. (Fig. **1**—1, 3); raide, vert-mousse; rhizoides à la base des axes principaux le plus souvent dichotomiques; axes principaux serrés, nombreux, rarement dichotomiques, longs de 2—5 cm, larges de ¾ mm, le plus souvent sans, parfois avec des branches du premier ordre à l'extrémité supérieure (longue de 2—4 mm), courtes, longues de ± 1 mm, généralement distiques; plumules plus ou moins triangulaires. Chromatophores ellipsoides à irrégulièrement allongés, longs de 12—28 μ, larges de 8—9 μ (Fig. **1**—11). *Anomalies*: des branches du premier ordre allongées portent des branches du deuxième ordre courtes (longues de ½ mm) au sommet extrême (Fig. **1**—6, 7). L'axe principal porte occasionnellement quelques

branches du premier ordre très longues (longues de 2½ cm), souvent avec des rhizoides à la base. Quelquefois l'axe principal porte des branches du premier ordre d'un seul côté (Fig. 1—4). Ce *Bryopsis* croît aussi sur *Pterocladia capillacea* en compagnie de *Bryopsis plumosa* et *Dictyota dichotoma*.

Bryopsis plumosa (HUDS.) AG. f. **penicillata** (SUHR) KOSTER; peu compact; irrégulièrement paniculé, haut de 2—5 cm; branches du premier ordre jusqu'à 1 cm de longueur, implantées presque le long de l'axe principal entier ou seulement à la partie supérieure, quelquefois non-ramifiées, minces, larges de ½ mm, quelquefois très distantes entre elles; branches du deuxième ordre seulement au sommet extrême, quelquefois avec peu de branches du troisième ordre; plumules irrégulièrement oblongs, le plus souvent peu compacts. Souvent il y a des rhizoides à la base des branches du premier ordre, se pressant fortement contre l'axe principal.

HABITAT n° 4: Posillipo, Villa da Luca.

Ulva Lactuca L., *Gigartina acicularis* (WULF.) LAMOUR., *Pterocladia capillacea* (GMELIN) BORN. et THUR., *Ceramium strictum* GREV. et HARV., *Corallina mediterranea* ARESCH. (rare), *Ceramium rubrum* (HUDS.) AG. (rare), *Porphyra leucosticta* THUR. (rare).

Bryopsis Balbisiana LAMOUR.; axes principaux non-dichotomiques, sans branches.

Bryopsis muscosa LAMOUR.; axes principaux dichotomiques ou non.

HABITAT n° 5: Posillipo, Villa Garunchio, sur les ruines d'un vieux mur romain de tuf, peu au-dessus du niveau de la mer, toujours arrosé, exposé à l'Est, dans eau limpide et assez agitée.

Ulva Lactuca L., *Ralfsia verrucosa* (ARESCH.) J. AG., *Ceramium strictum* GREV. et HARV., *Ceramium ciliatum* (ELLIS) DUCL., *Corallina mediterranea* ARESCH., *Pterocladia capillacea* (GMELIN) BORN. et THUR., *Gastroclonium clavatum* (ROTH) ARDISS. (rare), *Laurencia pinnatifida* (GMELIN) LAMOUR.

Bryopsis Balbisiana LAMOUR.; axes principaux non-dichotomiques, sans branches.

Bryopsis muscosa LAMOUR. (Fig. 2—1); pas très raide, vert-mousse; axes principaux nombreux, serrés, souvent dichotomiques, longs de 3—5 cm, larges de ½ mm, branches du premier ordre assez longues à la partie supérieure de l'axe principal, longues de 2—2½ mm, diminuant en longueur vers le sommet de l'axe principal (les extrêmes longues de ± 1 mm), émises en tous sens, serrées surtout au sommet, distantes entre elles de ½ mm, quelques-unes avec des branches du deuxième

ordre à des distances irrégulières; plumules larges et obtus, larges de ± 4 mm. Ce *Bryopsis* croît aussi sur des balanes et des patelles.

Bryopsis plumosa (Huds.) Ag. f. **adriatica** (J. Ag.) Hauck; très ramifié, long de 2½ cm; branches du premier ordre ramifiées dès la base. Chromatophores ellipsoides ou irrégulièrement allongés, longs de 12—32 μ, larges de 6—8 μ.

Habitat n° 6: Posillipo, Villa Garunchio, ± ½ m de profondeur, exposé au Nord-Est, sur tuf, dans eau presque stagnante.

Ulva Lactuca L., *Dictyota dichotoma* (Huds.) Lamour., *Pterocladia capillacea* (Gmelin) Born. et Thur., *Nitophyllum punctatum* (Stackh.) Grev., *Gigartina acicularis* (Wulf.) Lamour., *Griffithsia opuntioides* J. Ag., *Porphyra leucosticta* Thur., *Chondria coerulescens* Crouan, *Pleonosporium Borreri* (Sm.) Naeg.

Bryopsis Balbisiana Lamour.; axes principaux non-dichotomiques, sans branches.

Bryopsis plumosa (Huds.) Ag. f. **typica**; parmi ces plantes se trouvent des exemplaires avec des branches du deuxième ordre distiques et avec des branches du deuxième ordre émises en tous sens au sommet des branches du premier ordre. Des parties de l'axe principal périssent, des cloisons se forment à la base des branches du premier ordre (Fig. **2**—6) et ces branches se développent en plantes nouvelles. Un grand nombre de rhizoides naissent à la partie inférieure de l'axe principal (Fig. **2**—4). Quand l'axe principal est tout à fait mort, les rhizoides restent souvent vivants. Les plantes croissent aussi sur des *Rhodophycées*.

Epiphytes sur *Bryopsis plumosa*: des *Diatomées*.

Habitat n° 7: Posillipo, Villa Rocco Romano, sur une pierre de tuf horizontale, plate, un peu au-dessus du niveau de la mer, toujours arrosé, exposé au Nord-Est, dans eau limpide et fortement agitée.

Ulva Lactuca L., *Porphyra leucosticta* Thur., *Gelidium pusillum* (Stackh.) Le Jol., *Gigartina acicularis* (Wulf.) Lamour., *Chondria coerulescens* Crouan.

Bryopsis muscosa Lamour.

Bryopsis plumosa (Huds.) Ag. f. **penicillata** (Suhr) Koster; rhizoides à la base des branches du premier ordre; branches du deuxième ordre émises en tous sens.

Bryopsis plumosa (Huds.) Ag. f. **adriatica** (J. Ag.) Hauck.

Epiphytes sur *Bryopsis plumosa*: *Entocladia viridis* Reinke, *Erythrocladia subintegra* Rosenvinge, cellules intérieures larges de ± 4 μ, longues de ± 5 μ, cellules extérieures larges de ± 5 μ, longues de

7—8 μ, *Dermocarpa minima* GEITLER, de 3—10 μ de diamètre, très variable, bleu clair, endospores de 1 μ de diamètre.

HABITAT n° 8: Posillipo, Pietri di due Fratri (deux pierres de tuf devant le quai du port), au niveau de la mer, exposé à l'Est, dans eau limpide et assez agitée.

Ulva Lactuca L., *Cystoseira corniculata* (WULF.) ZANARD. (rare), *Porphyra leucosticta* THUR., *Gelidium pusillum* (STACKH.) LE JOL., *Gigartina acicularis* (WULF.) LAMOUR., *Chondria coerulescens* CROUAN, *Ceramium strictum* GREV. et HARV., *Corallina mediterranea* ARESCH. avec *Melobesia Corallinae* CROUAN (épiphyte).

Bryopsis Balbisiana LAMOUR.: axes principaux non-dichotomiques, le plus souvent sans branches, quelquefois avec une seule branche du premier ordre au sommet.

Bryopsis muscosa LAMOUR. (Fig. **1**—13); tout à fait comme la figure du type (Journ. de Bot. II (1809) T. I, fig. 4a): beaucoup plus bas que les branches du premier ordre à l'extrémité supérieure, émises en tous sens et serrées, se trouvent encore quelques autres plus distantes entre elles; plumules courts, gros, obtus. *Anomalies*: branches du premier ordre quelquefois allongées, avec des branches du deuxième ordre émises en tous sens et serrées à l'extrémité supérieure, formant un plumule (Fig. **1**—16). Des rhizoides se forment occasionnellement à la base de ces branches du premier ordre allongées, en se pressant contre l'axe principal à la manière d'une écorce (Fig. **1**—17).

HABITAT n° 9: Posillipo, Pietri di due Fratri (deux pierres de tuf, devant le quai du port), un peu au-dessus du niveau de la mer, mais toujours arrosé, exposé à l'Ouest, dans eau limpide et légèrement agitée.

Ulva Lactuca L., *Cladophora prolifera* (ROTH) KÜTZ., *Cladophora utriculosa* KÜTZ., *Ralfsia verrucosa* (ARESCH.) J. AG., *Porphyra leucosticta* THUR., *Corallina mediterranea* ARESCH., *Caulacanthus ustulatus* (MERT.) KÜTZ.

Bryopsis Balbisiana LAMOUR.; axes principaux non-dichotomiques, sans branches.

Bryopsis muscosa LAMOUR.; la plupart des axes principaux non-dichotomiques, longs de 3—4 cm avec des branches du premier ordre à la partie supérieure ($^1/_3$ de la longueur); plumules larges de 2 mm. Chromatophores ellipsoides, longs de ± 24 μ, larges de ± 7 μ (Fig. **1**—21).

Bryopsis muscosa LAMOUR.; axes principaux souvent dichotomiques.

HABITAT n° 10: Posillipo, Palazzo Donn'Anna, ½—1 m de pro-

fondeur, au pied d'un mur haut de ± 20 m, exposé au Nord, sur tuf, dans eau limpide et presque stagnante.

Ulva Lactuca L., *Cladophora utriculosa* Kütz., *Nitophyllum punctatum* (Stackh.) Harv., *Corallina mediterranea* Aresch., *Pterocladia capillacea* (Gmelin) Born. et Thur.

Bryopsis Balbisiana Lamour.; axes principaux non-dichotomiques, sans branches.

Bryopsis plumosa (Huds.) Ag. f. **typica** (Fig. **2**—2); vert-mousse, assez raide, plat, très ramifié; rhizoides dichotomiques, larges de ½—1 mm; axes principaux 1—10 agglomérés, rarement dichotomiques, longs de 5—9 cm, assez épais, larges de ½—1 mm; branches du premier ordre implantées de 7—35 mm au-dessus de la base jusqu'au sommet, distiques, sur le même plan, serrées, quand elles sont jeunes, distantes plus tard de 1—4 mm, longues de 3—60 mm, d'abord non-ramifiées et larges de ± 80 μ, plus tard avec des branches du deuxième ordre généralement à la partie supérieure la plus grande. Branches des premier et deuxième ordres formant ensemble un plumule plat, lancéolé, oblong et pointu. Branches du deuxième ordre distiques, opposées, sur le même plan, diminuant en longueur vers le sommet, quelquefois avec des branches du troisième ordre courtes (longues de ± ½ mm), distiques, sur le même plan, parfois naissant tout près de la base. Chromatophores ellipsoides à irrégulièrement oblong-ellipsoides, avec un ou deux pyrénoides, larges de ± 8 μ, longs 20—44 μ (Fig. **2**—7). Ce *Bryopsis* croît aussi sur *Pterocladia capillacea.*

Bryopsis plumosa (Huds.) Ag. f. **gracilis** Koster (Fig. **2**—13, 14, 15); vert-mousse, peu compact; rhizoides dichotomiques, courts. Axes principaux en grand nombre agglomérés, longs de 1½—7 cm, minces, larges de ± ½ mm; branches du premier ordre le plus souvent distantes entre elles, implantées à ½—4 mm au-dessus de la base jusqu'au sommet, formant un angle aigu vers le sommet, les branches supérieures émises en tous sens, non-ramifiées et larges de ± 80 μ, courtes, ou bien ramifiées et longues (longues de 1½—20 μ). Branches du deuxième ordre implantées à 3—5 mm au-dessus de la base des branches du premier ordre, les supérieures émises en tous sens, la plupart de la même longueur, excepté les extrêmes diminuant en longueur vers le sommet. Plumules très étroits et pointus, larges de 3 mm. Quelquefois des branches du premier ordre détachées émettent des rhizoides à la base avec lesquels elles s'attachent de nouveau à l'axe principal. Cette forme croît aussi sur *Pterocladia capillacea* et d'autres *Rhodophycées.* Elle diffère du type par les branches émises en tous sens

surtout à la partie supérieure de l'axe principal, les branches distantes et courbées vers l'axe principal, et les plumules étroits. La forme *adriatica* (J. AG.) HAUCK est plus courte et a des plumules plus arrondis, tandis que les branches du premier ordre sont écartées, serrées et plus au moins distiques.

HABITAT n° 11: Posillipo, Palazzo Donn'Anna, à une distance de 6 m d'un mur haut de ± 20 m; ½ -1 m de profondeur, exposé au Nord-Est, sur tuf, dans eau limpide et presque stagnante.

Ulva Lactuca L. (rare), *Cladophora prolifera* (ROTH) KÜTZ., *Cladophora utriculosa* KÜTZ., *Haliseris polypodioides* (DESF.) AG., *Pterocladia capillacea* (GMELIN) BORN. et THUR. avec *Griffithsia Schousboei* MONT. (épiphyte), *Nithophyllum punctatum* (STACKH.) GREV., *Hypnea musciformis* (WULF.) LAMOUR.

Bryopsis Balbisiana LAMOUR.: axes principaux tous dichotomiques; avec des branches du premier ordre au sommet (2 -3 mm de longueur), distiques, sur le même plan, longues de 1 mm. *Anomalie* croissant sur *Pterocladia capillacea*; une pelote cylindrique, très courte, longue de 1½ cm, autour du thallus de *Pterocladia*, axes principaux non-dichotomiques, non-ramifiés.

HABITAT n° 12: Posillipo, Palazzo Donn'Anna, au pied d'un mur haut de 20 m, au niveau de la mer, exposé au Sud-Est, sur tuf, rocheux, dans eau limpide et presque stagnante.

Ulva Lactuca L., *Chaetomorpha tortuosa* (DILLW.) KÜTZ., *Corallina mediterranea* ARESCH., *Caulacanthus ustulatus* (MERT.) KÜTZ.

Bryopsis muscosa LAMOUR. (Fig. **1**—15, 20); vert-mousse; axes principaux le plus souvent non-ramifiés, rarement une ou deux fois dichotomiques, longs de 3—4½ cm, avec des branches du premier ordre émises en tous sens à la partie supérieure, longues de ± 1 mm; occasionnellement quelques-unes plus basses distantes entre elles. Plumules étroits et longs, longs de 8 mm, larges de 2 mm, presque pointus jusqu'à obtus. Rhizoides à la base des branches du premier ordre, se pressant contre l'axe principal, qui a perdu le contenu protoplasmatique. Le *Bryopsis* forme une ceinture.

Bryopsis plumosa (HUDS.) AG. f. **adriatica** (J. AG.) HAUCK; long de ± 2 cm; branches du premier ordre serrées, écartées; branches du deuxième ordre émises en tous sens. Plumules courts, obtus. Rhizoides à la base des branches du premier ordre se pressant contre l'axe principal.

Epiphytes sur *Bryopsis muscosa*: *Entocladia viridis* REINKE sur les axes principaux, *Erythrocladia subintegra* ROSENVINGE.

Habitat n° 13: Posillipo, Palazzo Donn'Anna, 10—20 cm au-dessus du niveau de la mer, toujours arrosé, exposé au Sud-Est, sur tuf, dans eau limpide et assez agitée.

Ulva Lactuca L., *Porphyra leucosticta* Thur., *Corallina mediterranea* Aresch., *Chondria coerulescens* Crouan, *Ceramium strictum* Grev. et Harv., *Caulacanthus ustulatus* (Mert.) Kütz.

Bryopsis muscosa Lamour.; il y a deux formes: *1º* branches du premier ordre à la partie supérieure ($^1/_3$—$^1/_2$ de la longueur) de l'axe principal; plumules longs, étroits, pointus, larges de 2 mm, longs de $\pm$ $1^1/_2$ cm; *2º* axes principaux plusieurs fois dichotomiques, courts, compacts; plumules longs de 7 mm, larges de 2 mm.

Habitat n° 14: Posillipo, Principia di Posillipo, port, sur des coquilles de moules et d'huîtres et sur des balanes, qui sont fixés aux môles; $\pm$ 30 cm au-dessous du niveau de la mer, exposé à l'Est, dans eau assez sale et presque stagnante.

Ulva Lactuca L., *Ceramium rubrum* (Huds.) Ag., *Pleonosporium Borreri* (Sm.) Naeg.

Bryopsis Balbisiana Lamour. (Fig. 1—9, 10); axes principaux non-dichotomiques ou une à plusieurs fois dichotomiques, longs de $\pm$ 5 cm; branches du premier ordre au sommet extrême (long de 1½—2½ mm), distiques, sur le même plan, longues de 1 mm, quelques-unes allongées avec peu de branches du deuxième ordre, très courtes, distiques; plumules larges de 2 mm; rhizoides émises au milieu de l'axe principal.

Epiphytes sur *Bryopsis Balbisiana*: des *Diatomées* couvrant une grande partie des axes principaux, *Ceramium rubrum* (Huds.) Ag., plantes jeunes, longues de 1½—2 cm, peu ou non-ramifiées, *Erythrotrichia ciliaris* (Carmich.) Thur., *Goniotrichum Alsidii* (Zanard.) Howe (syn. *Goniotrichum elegans* (Chauvin) Le Jol.), *Callithamnion* spec.

Habitat n° 15: Mergellina, port, derrière des môles (exposées à l'Est) distant de $\pm$ 2 m, à une profondeur de 2½ m, sur le fond de la mer, sur des pierres et sur des coquilles d'huîtres dans eau presque stagnante.

Vaucheria ? piloboloides Thur. (sterile), *Ulva Lactuca* L. (rare), *Cladophora utriculosa* Kütz., *Chaetomorpha aerea* (Dillw.) Kütz., *Ectocarpus confervoides* (Roth) Le Jol., *Gigartina Teedii* (Roth) Lamour. (rare), *Griffithsia furcellata* J. Ag. (= *Neomonospora furcellata* (J. Ag.) Feldmann-Mazoyer), *Chylocladia compressa* (Kütz.) Ardiss., *Gracilaria confervoides* (L.) Grev.

Bryopsis Balbisiana Lamour. (Fig. 1—8): axes principaux dichotomiques ou non-dichotomiques, courbés ou droits, irréguliers, souvent

avec des branches du premier ordre à l'extrémité supérieure (longue de 2—20 mm), distiques, sur le même plan, rarement avec des branches du deuxième ordre. Beaucoup de rhizoides partant de l'axe principal, peut-être est-ce une réaction contre les circonstances défavorables. Tout à fait couvert de *Vaucheria*.

Bryopsis plumosa (HUDS.) AG. f. **typica**; longue de ± 2 cm avec des branches du premier ordre de 1 cm de la base, dont les inférieures portent des branches du deuxième ordre courtes à l'extrémité supérieure; plumules très pointus, larges de ± 5 mm. Plantes jeunes, sur une coquille d'huître (Fig. **2**—3). *Anomalie*, longue de ± 2 cm; des fragments du vieil axe principal avec des branches du premier ordre, qui souvent émettent des rhizoides à la base et qui portent à la partie supérieure la plus grande des branches du deuxième ordre, distiques presque sur le même plan ou émises en tous sens, souvent courbées, longues et minces (Fig. **2**—5), diminuant irrégulièrement en longueur vers le sommet, quelquefois avec quelques branches du troisième ordre courtes à l'extrémité supérieure. Cette forme semble un produit de régénération.

Epiphytes sur *Bryopsis Balbisiana*: des *Diatomées* couvrant d'importantes parties de l'axe principal, *Erythrotrichia ciliaris* (CARMICH.) THUR.

HABITAT n° 16: Mergellina, port, sur des coquilles d'huîtres et sur des balanes, qui sont fixés à un bateau ancré, à 1½ m de profondeur, quelques plantes au niveau de la mer, exposé au Sud, dans eau sale non transparente et peu agitée.

Ectocarpus confervoides (ROTH) LE JOL., *Chylocladia compressa* (KÜTZ.) ARDISS., *Griffithsia furcellata* J. AG. (= *Neomonospora furcellata* (J. AG.) FELDMANN-MAZOYER).

Bryopsis plumosa (HUDS.) AG. f. **typica**; grand, long de ± 8 cm; plumule composé de branches du deuxième et troisième ordre, longues de 10—20 mm, larges de 4—12 mm.

Bryopsis plumosa (HUDS.) AG. f. **elongata** KOSTER; vert-bronze, peu compact; axes principaux ± 15, agglomérés, très allongés, longs de 13—18 cm, larges de ± 1 mm, souvent rompus au sommet, avec des branches du premier ordre depuis 1—1½ cm de la base, irrégulièrement rangées, sans doute originairement distiques, nombreuses, souvent très longues, longues de 1½—11 cm, larges de ± ½ mm, avec peu de branches du deuxième ordre à partir de 2 cm de la base; branches du deuxième ordre irrégulièrement distantes entre elles, souvent avec des rhizoides à la base se pressant contre l'axe principal, avec des branches

du troisième ordre à l'extrémité supérieure, qui sont longues de 2—20 mm, plus ou moins nombreuses (quelquefois absentes), assez distantes entre elles, le plus souvent distiques, sur le même plan, les plus longues avec des branches à l'extrémité supérieure (longue de 4—11 mm), distiques, longues de ± 2 mm. Chromatophores ovoides à irrégulièrement allongés, quelquefois courbés, larges de ± 6 μ, longs de 10—50 μ, serrés, très nombreux (Fig. **2**—16).

Epiphytes sur *Bryopsis plumosa*: des *Diatomées.*

Habitat n° 17: Naples, devant la Via Caracciolo, sur *Caulerpa prolifera,* ± 1 m de profondeur.

Bryopsis plumosa (Huds.) Ag., assez raide, avec des rhizoides peu au-dessus de la base; axe principaux longs de 1½—3 cm; branches du troisième ordre manquant; plumules à la moitié supérieure de l'axe principal lancéolés, très pointus. Trois plantes jeunes.

Habitat n° 18: Santa Lucia, Castello dell'Uova, au pied d'un mur, haut de ± 15 m, sur des coquilles de moules et d'huîtres et sur tuf, aussi bien sur pente perpendiculaire que sur pente faible, au niveau de la mer, toujours arrosé, exposé à l'Ouest, dans eau limpide et fort agitée.

Ulva Lactuca L., *Porphyra leucosticta* Thur., *Ceramium rubrum* (Huds.) Ag., *Corallina mediterranea* Aresch.

Bryopsis Balbisiana Lamour.; axes principaux non-dichotomiques ou une à plusieurs fois dichotomiques, le plus souvent sans branches. (Fig. **1**—2.)

Bryopsis muscosa Lamour.; axes principaux non-dichotomiques ou une à plusieurs fois dichotomiques; branches du premier ordre longues de 2—5 mm, quelquefois avec des branches du deuxième ordre à l'extrémité supérieure, émises en tous sens, serrées (Fig. **1**—19). Les branches du premier ordre quelquefois développées en rhizoides. Le *Bryopsis* croît en touffes.

Habitat n° 19: Santa Lucia, Castello dell'Uova, contre un mur perpendiculaire, sur tuf, au niveau de la mer, exposé au Nord, dans eau assez limpide et assez agitée.

D'autres espèces manquent.

Bryopsis Balbisiana Lamour.; axes principaux non-dichotomiques ou une à plusieurs fois dichotomiques, longues de 4—5 cm, sans ou avec branches du premier ordre à l'extrémité supérieure (longue de 3—5 mm). Le *Bryopsis* forme une ceinture.

Epiphyte sur *Bryopsis Balbisiana*: *Dermocarpa minima* Geitler,

cellules serrées ou non, glauque pâle, de 5—8 μ de diamètre, presque sphériques.

HABITAT n° 20: Santa Lucia, près des bains, contre un mur vertical de grès, ± 1½ m de hauteur, au niveau de la mer et jusqu'à ± 30 cm de profondeur, exposé au Nord-Est, dans eau assez limpide et presque stagnante.

Ulva Lactuca L.

Bryopsis Balbisiana LAMOUR.: axes principaux non-dichotomiques ou une à plusieurs fois dichotomiques, longs, d'une longueur de 4—6 cm.

Bryopsis plumosa (HUDS.) AG. f. **elongata** KOSTER; peu compact, axes principaux allongés, longs de 7—12 cm; branches du premier ordre nombreuses, assez serrées, longues de 2—8 cm, minces, larges de ½ mm, la plus grande moitié inférieure sans branches du deuxième ordre. Branches du deuxième ordre souvent non-ramifiées ou avec peu de branches du troisième ordre au sommet.

Epiphytes sur *Bryopsis Balbisiana*: des *Diatomées* couvrant les axes principaux pour la plus grande partie, *Polysiphonia variegata* (AG.) ZANARD., long de ½—5½ cm, avec des anthéridies, des cystocarpes et des tétraspores, *Griffithsia furcellata* J. AG. (= *Neomonospora furcellata* (J. AG.) FELDMANN-MAZOYER) et *Cladophora utriculosa* KÜTZ. (rare).

HABITAT n° 21: Santa Lucia, port, sur un morceau de lave sous-marin, 20—40 cm de profondeur, distant de 3 m des môles (± 1 m de hauteur), exposé au Sud-Est, dans eau assez sale et presque stagnante.

Ulva Lactuca L., *Vaucheria? piloboloides* THUR. (stérile), *Dictyota dichotoma* (HUDS.) LAM., *Dictyota linearis* (AG.) GREV.

Bryopsis plumosa (HUDS.) AG. f. **typica**; assez peu compact, long de 2½—6 cm; branches du premier ordre longues, d'une longueur de 2—7 mm, serrées. Sur *Pterocladia capillacea*.

HABITAT n° 22: Santa Lucia, port, contre un mur perpendiculaire de grès, au niveau de la mer et plus bas, jusqu'à ± 20 cm, exposé au Nord-Est, dans eau très sale et peu agitée.

Ulva Lactuca L., *Cladophora utriculosa* KÜTZ. (rare), *Chaetomorpha Linum* (FL. DAN.) KÜTZ. (syn. *Chaetomorpha tortuosa* FUNK p.p. non (DILLW.) KÜTZ.), filaments larges de 200 μ, crépus, avec des *Bangiales* épiphytes, *Dictyota dichotoma* (HUDS.) LAM. (± 20 cm plus bas), *Dictyota linearis* (AG.) GREV., *Griffithsia furcellata* J. AG. (= *Neomonospora furcellata* (J. AG.) FELDMANN-MAZOYER), *Chondria coerulescens*

Crouan (des exemplaires petits), *Gelidium pusillum* (Stackh.) Le Jol., *Grateloupia Proteus* Kütz.

Bryopsis Balbisiana Lamour. (Fig. 1—5); rhizoides nombreux; axes principaux non-dichotomiques ou une à plusieurs fois dichotomiques, longues de 5—7 cm, avec des branches du premier ordre, à l'extrémité supérieure (longue de 5—6 mm), longues de ± 1½ mm; plumules larges de 1—1½ mm, assez obtus au sommet.

Bryopsis plumosa (Huds.) Ag. f. **typica**; branches du premier ordre longues de 2—6 cm, serrées, distiques, sur le même plan; souvent avec des rhizoides à la base, avec des branches du deuxième ordre à 2—3 cm de la base, quelquefois non-ramifiées; branches du deuxième ordre longues de 2—3 mm, quelquefois avec des branches du troisième ordre. Les plantes ♀ avec des macrogamétanges, formés de branches du troisième ordre inférieures, d'un vert plus foncé que les branches stériles; macrogamètes très mobiles après la libération, longs de 10—11 μ, larges de 5—6 μ, piriformes, remplis du chromatophore pour la plus grande partie, pour la plus petite partie sans couleur, avec un stigma rouge. Les plantes ♂ avec des microgamétanges, formés de branches du deuxième ordre inférieures sans branches du troisième ordre, orange-brûnâtre pâle; les microgamètes très mobiles après la libération, longs de 7—8 μ, larges de 1½ μ, étroits, piriformes, presque sans couleur. *Anomalie*, une plante courte, presque sphérique, longue de 1 cm, composée de rhizoides en pelote, de ± 100 μ de diamètre et de branches du premier ordre détachées avec des branches du deuxième ordre distiques. Probablement le produit de régénération. Sur *Gelidium pusillum*.

Epiphytes sur *Bryopsis Balbisiana*: des *Diatomées* couvrant une grande partie des axes principaux.

3. ASSOCIATIONS.

Associations, dans lesquelles les *Bryopsis* se trouvent en avril-mai dans le Golfe intérieur de Naples.

Bryopsis Balbisiana Lamour. a pour compagnons les plus fréquents: *Ulva Lactuca* L., *Cladophora utriculosa* Kütz., *Porphyra leucosticta* Thur., *Pterocladia capillacea* (Gmelin) Born. et Thur., *Corallina mediterranea* Aresch., *Gigartina acicularis* (Wulf.) Lamour., *Nitophyllum punctatum* (Stackh.) Grev., *Gelidium pusillum* (Stackh.) Le Jol., tandis que *Dictyota dichotoma* (Huds.) Lamour., *Ceramium rubrum* (Huds.) Ag., *Ceramium strictum* Grev. et Harv., *Chondria coerulescens* Crouan sont moins fréquents. De plus un grand nombre de *Rhodophycées*, un nombre plus restreint de *Phéophycées* et quelques *Chlorophycées* ont

été trouvées dans l'association. Une seule fois une ceinture de *Bryopsis Balbisiana* pure a été trouvée. L'habitat était un mur perpendiculaire dans de l'eau assez agitée.

Bryopsis muscosa LAMOUR. se trouve dans une association, qui se compose surtout de *Ulva Lactuca* L., *Porphyra leucosticta* THUR., *Corallina mediterranea* ARESCH., *Ceramium strictum* GREV. et HARV., *Caulacanthus ustulatus* (MERT.) KÜTZ., *Gigartina acicularis* (WULF.) LAMOUR., *Gelidium pusillum* (STACKH.) LE JOL. et moins souvent de *Pterocladia capillacea* (GMELIN) BORN. et THUR., *Chondria coerulescens* CROUAN, *Ceramium rubrum* (HUDS.) AG. Parmi les espèces trouvées une seule fois il y a quelques *Cladophora*.

Bryopsis plumosa (HUDS.) AG. croît au milieu d'une grande variabilité surtout de *Rhodophycées* et de quelques *Chlorophycées* et *Phéophycées*; f. **typica** a comme compagnons outre *Ulva Lactuca* L. surtout *Cladophora utriculosa* KÜTZ., *Dictyota dichotoma* (HUDS.) LAMOUR., *Griffithsia furcellata* J. AG. (= *Neomonospora furcellata* (J. AG.) FELDMANN-MAZOYER), moins souvent *Vaucheria? piloboloides* THUR., *Ectocarpus confervoides* (ROTH) LE JOL., *Dictyota linearis* (AG.) GREV., *Pterocladia capillacea* (GMELIN) BORN. et THUR., *Nithophyllum punctatum* (STACKH.) GREV., *Chondria coerulescens* CROUAN, *Chylocladia compressa* (KÜTZ.) ARDISS.; f. **penicillata** (SUHR) KOSTER a pour compagnons outre *Ulva Lactuca* L., souvent *Gigartina acicularis* (WULF.) LAMOUR. et *Gelidium pusillum* (STACKH.) LE JOL.; f. **adriatica** (J. AG.) HAUCK n'a pas été trouvée dans une association constante, tandis que f. **elongata** KOSTER et f. **gracilis** KOSTER n'ont été trouvées que deux et une fois.

FUNK (1927) suppose que les algues rudérales comme *Ulva* et *Enteromorpha* disséminées d'un port à l'autre refoulent la flore algale originaire. Il est vrai que *Ulva Lactuca* L. ne manque dans aucun association. Selon le pêcheur, le *Bryopsis* se montre en mars aux murs du port de Mergellina et Principia di Posillipo au niveau de la marée basse, mais là il est refoulé bientôt par la croissance abondante de l'*Ulva*.

4. MORPHOLOGIE ET SYSTEMATIQUE.

On peut distinguer les espèces étudiées, qui sont toutes les trois variables, selon leur ramification. Les trois espèces trouvées ensemble sur le même habitat présentent à peine de formes intermédiaires, de sorte que les espèces sont assez distinctes. FELDMANN (1937) a figuré les chromatophores de quelques espèces. On peut à peine juger carac-

téristique la forme des chromatophores des *Bryopsis* à cause de la variabilité dans la même espèce et la concordance dans les espèces différentes.

Bryopsis Balbisiana Lamour. Essai sur les Thallophytes (1813) 66, Pl. 7, fig. 2; Feldmann in Rev. Algol. IX (1937) 225, fig. 27 B — *Bryopsis disticha* (J. Ag.) Kütz. Tab. Phyc. VI (1856) 27, T. 76, fig. I; Hauck, Meeresalg. D. u. Oe. (1885) 474; Funk in Publ. Staz. Zool. Napoli 7 (1927) 330, fig. 17 c, 18; Hamel, Chloroph. côtes franç. (1930) 63, fig. 21 e — Vert-mousse, raide, moins compact plus tard; souvent les axes principaux ne sont qu'une cellule allongée non-ramifiée. En ce cas il est difficile de distinguer cette espèce d'un exemplaire stérile de *Derbesia Lamourouxii* (J. Ag.) Solier, comme Hamel (1930) 64 indique. Cependant la rigidité de la plante vivante est un indice certain pour la *Bryopsis*. Les axes principaux courbés ou droits, longs de 2—7 cm, de ± ¾ mm de diamètre, en touffes épaises sont dichotomiques ou non-dichotomiques, quelquefois ils le sont plusieurs fois et tous ou un certain nombre d'entre eux portent quelquefois des branches du premier ordre plus ou moins distiques, longues de ± 1 mm, sur le même plan, à la partie supérieure (longue de 1½—20 mm), exceptionnellement d'un seul côté. Le cas où les branches du premier ordre allongées portent des branches du deuxième ordre extrêmement courtes au sommet extrême est anormal. La production de quelques branches du premier ordre très longues est de même anormal, ainsi qu'une forme compacte composée d'axes principaux pas plus longues que 1½ cm, enveloppant le thallus de *Pterocladia capillacea,* formant une pelote cylindrique. Des rhizoides sont émis quelquefois en grand nombre, sortant partout de l'axe principal, souvent de la base, le plus souvent dichotomiques et se terminant rarement en sommet sphérique. Les chromatophores sont ovales à irrégulièrement allongés, larges de 8—9 μ, longs de 12—28 μ. Puisque le degré de ramification dichotomique, ainsi que la possession de branches du premier ordre varient dans la même touffe, qui appartient peut-être au produit d'une seule zygote ou bien d'un seul fragment de thallus, la distinction en formes est sans importance.

Bryopsis muscosa Lamour. in Journ. de Bot. II (1809) 135, Pl. I, fig. 4 a, b; Kütz. Tab. Phyc. VI (1856) 29, T. 82, fig. I; Hauck (1885) 474; Funk l. c. (1927) 328, fig. 17 b; Hamel l. c. (1930) 64, fig. 21 a; Feldmann l. c. (1937) 231, fig. 23 VII — Vert-mousse, assez peu compact; des axes principaux serrés, nombreux, le plus souvent non-ramifiés, mais souvent une ou plusieurs fois dichotomiques, larges

de ± ½ mm, longs de 2—5 cm, portent à la partie supérieure des branches du premier ordre émises en tous sens, serrées, longues de 1—2½ mm. Les plumules formés ainsi sont courts, largement arrondis à presque applatis au sommet, ou bien longs, étroits et presque pointus au sommet, larges de 2—4 mm, longs de 3—15 mm. Souvent un certain nombre de branches du premier ordre distantes entre elles se trouvent plus bas que le plumule comme dans l'image du type, mais souvent aussi celles-ci manquent. Dans de rares cas les branches du premier ordre portent des branches du deuxième ordre au sommet extrême. Dans un seul cas des branches du premier ordre s'étaient développées en rhizoides, dans un autre cas elles étaient partiellement distiques et sur le même plan. Des rhizoides se forment à des endroits quelconques sur l'axe principal, souvent à la base, aussi bien qu'à la base des branches du premier ordre. Souvent ils se pressent contre l'axe principal à la manière d'une écorce.

Fig. 1 — 1–21, *Bryopsis Balbisiana* LAMOUR.: 1. axe principal non-ramifié avec rhizoide, forme la plus courante, hab. 3; 2. axe principal dichotomique sans branches, hab. 18; 3. axe principal avec des branches du premier ordre distiques à l'extrémité supérieure, forme assez fréquente, hab. 3; 4. axe principal avec quelques branches du premier ordre d'un seul côté, forme exceptionnelle, hab. 3; 5. axe principal dichotomique avec des branches du premier ordre distiques à l'extrémité supérieure, hab. 22; 6. axe principal avec des branches du premier ordre allongées, portant des branches du deuxième ordre à l'extrémité supérieure, forme exceptionnelle, hab. 3; 7. partie supérieure d'une pareille forme, hab. 3; 8. formation d'un grand nombre de rhizoides, hab. 15; 9. axe principal plusieurs fois dichotomique, hab. 14; 10. partie supérieure avec des branches du premier ordre, dont quelques-unes portent des branches du deuxième ordre minuscules et distiques, forme exceptionnelle, hab. 14; 11. chromatophores, hab. 3; — 12–21, *Bryopsis muscosa* LAMOUR.: 12. axe principal avec des branches du premier ordre émises en tous sens à la partie supérieure avec des rhizoides, forme la plus courante, hab. 1; 13. quelques branches du premier ordre plus bas que les autres, forme assez courante, hab. 8; 14. axe principal dichotomique, forme assez courante, hab. 1; 15. axe principal deux fois dichotomique, forme occasionnelle, hab. 12; 16. branches supérieures du premier ordre répétant la ramification de l'axe principal, forme exceptionnelle, hab. 8; 17. quelques branches inférieures pareilles à celles de la forme précédente émettant de longs rhizoides, qui se pressent contre l'axe principal à la manière d'une écorce, hab. 8; 18. axe principal plusieurs fois dichotomique avec des rhizoides à des endroits quelconques de l'axe principal, hab. 1; 19. branches du premier ordre portant des branches du deuxième ordre émises en tous sens à la partie supérieure; des rhizoides naissent à des endroits quelconques de l'axe principal et aux branches du premier ordre, hab. 18; 20. axe principal avec partie basale des branches, émettant des rhizoides, hab. 12; 21. chromatophores, hab. 9; 1–6, 8, 9, 12–19, $\times 1$; 7, $\times 5$; 10, 20, $\times 8$; 11, 21, $\times 250$.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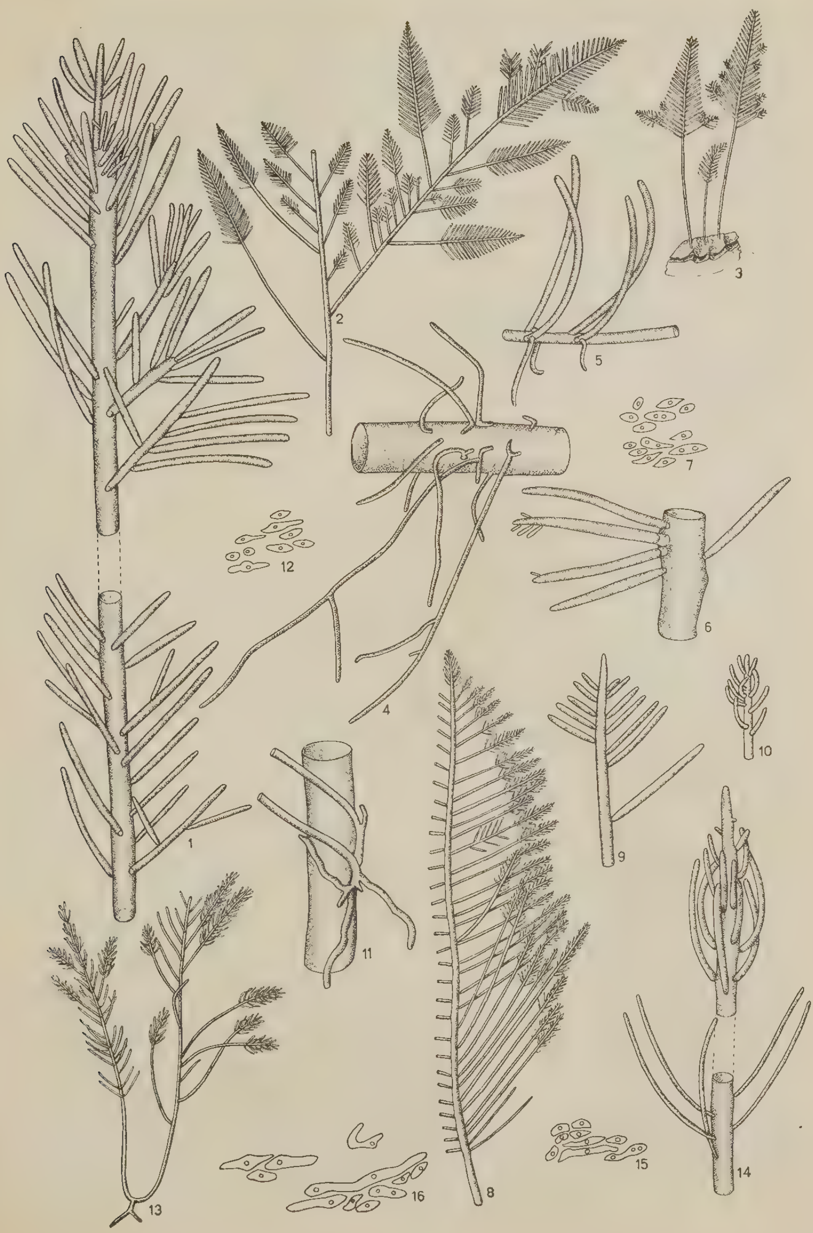
Bryopsis plumosa (HUDS.) AG. Sp. Alg. (1823) 448; KÜTZ. Tab. Phyc. VI (1856) 29, T. 83, fig. II; HAUCK l. c. (1885) 472, fig. 208; FUNK l. c. (1927) 328, fig. 17 a; HAMEL l. c. (1930) 61, fig. 20 C; FELDMANN l. c. (1937) 220 — *Bryopsis cupressoides* FUNK l. c. (1927) 328, fig. 17 d, non KÜTZ. — Presque toujours vert-mousse, plus ou moins raide, plus ou moins compact; axes principaux le plus souvent en grand nombre, agglomérés, rarement dichotomiques, longs de 2—18 cm, assez épais, larges ½—1 mm, portant dès la base à des distances variables des branches du premier ordre distiques, longues de 1½—110 mm, sur le même plan, serrées quand jeunes, distantes de 1—4 mm plus tard, d'abord non-ramifiées, mais portant plus tard, à la moitié supérieure, des branches du deuxième ordre distiques, sur le même plan, ou partiellement émises en tous sens, longues de 1—12 mm, diminuant en longueur vers le sommet, droites ou courbées vers le sommet. Les plumules formés ainsi sont plus ou moins compacts, larges de 5—25 mm, triangulaires ou irréguliers. Souvent les branches du deuxième ordre portent des branches du troisième ordre (souvent dès la base), le plus souvent distiques, sur le même plan, longues de ± 1 mm. Des rhizoides dichotomiques sont émis à la base de l'axe principal ou un peu plus haut et souvent à la base des branches du premier ordre. Souvent ils

Fig. 2 — 1, *Bryopsis muscosa* LAMOUR., forme irrégulière, forme de régénération, hab. 5, × 4; — 2–7, *Bryopsis plumosa* (HUDS.) AG. f. *typica*: 2. axe principal avec des branches des premier, deuxième et troisième ordres, toutes distiques et sur le même plan, hab. 10, × 1½; 3. plantes jeunes sur une coquille d'huître, hab. 15, × 1½; 4. axe principal avec formation abondante de rhizoides, hab. 6, × 8; 5. branche du premier ordre avec des branches du deuxième ordre émettant des rhizoides à la base, hab. 15, × 6; 6. partie d'un vieil axe principal, presque tout à fait déperi sans contenu vivant avec des branches vivantes du premier ordre se fermant aux parties basales, hab. 6, × 10; 7. chromatophores, hab. 10, × 250; — 8–12, *Bryopsis plumosa* (HUDS.) AG. f. *penicillata* (SUHR) KOSTER: 8. axe principal avec des branches des premier et deuxième ordres, toutes distiques, hab. 2, × 2; 9. sommet d'une branche du premier ordre avec des branches du deuxième ordre distiques, hab. 2, × 5; 10. sommet d'une autre branche du premier ordre avec des branches du deuxième ordre émises en tous sens, hab. 2, × 4; 11. axe principal avec des branches du premier ordre émettant des rhizoides, hab. 2, × 8; 12. chromatophores, hab. 2, × 250; — 13–15, *Bryopsis plumosa* (HUDS.) AG. f. *gracilis* KOSTER: 13. axe principal avec des branches des premier et deuxième ordres, les supérieures émises en tous sens, hab. 10, × 1; 14. branches du premier ordre minces émises en tous sens, hab. 10, × 5; 15, chromatophores, hab. 10, × 250; — 16, *Bryopsis plumosa* (HUDS.) AG. f. *elongata* KOSTER, chromatophores, hab. 16, × 250.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se pressent contre l'axe principal à la manière d'une écorce. Les chromatophores sont ellipsoides à irrégulièrement oblongs avec une ou deux pyrénoides, longs de 5—32 μ, quelquefois jusqu'à 50 μ, larges de 4—8 μ. Une seule plante sphérique anormale haute de ± 1 cm, composée de rhizoides et de branches du premier ordre détachées avec des branches du deuxième ordre distiques a été trouvée. Les macrogamétanges naissent des branches du troisième ordre inférieures, qui sont d'un vert plus foncé; les macrogamètes sont piriformes, très mobiles, longs de 10—11 μ, larges de 5—6 μ, remplis du chromatophore pour la plus grande partie, pour la partie la plus petite sans couleur, avec un stigma rouge. Les microgamétanges naissent des branches du deuxième ordre sans branches du troisième ordre; les microgamètes sont étroits et piriformes, très mobiles, longs de 7—8 μ, larges de 1½ μ, presque sans couleur.

f. **typica**; raide ou assez raide, long de 2—9 cm; toutes les branches distiques, sur le même plan. Plumules plats, plus ou moins triangulaires, pointus au sommet.

f. **adriatica** (J. AG.) HAUCK Meeresalg. D. u. Oe. (1885) 473 — *Bryopsis adriatica* MENEGH. in KÜTZ.! Tab. Phyc. VI (1856) 28, T. 79, fig. II; HAMEL l.c. (1930) 69, fig. 20 A; FELDMANN l.c. (1937) 222, fig. 25 B, 26 B, C; court, d'une longueur de 2—3½ cm, assez raide; branches du premier ordre serrées, écartées, branches du deuxième ordre supérieures émises en tous sens.

f. **penicillata** (SUHR) comb. nov. — *Bryopsis penicillata* SUHR! in SEUBERT Fl. Azorica (1844) 9, T. I, fig. I, fig. 1, 1 a, 1 b — *Bryopsis cupressoides* KÜTZ.! Tab. Phyc. VI (1856) 29, T. 79, fig. I; FELDMANN l.c. (1937) 224, fig. 25 A, 26 A — non KÜTZ.! Tab. Phyc. VI (1856) 28, T. 78, fig. II; très peu compact, long de 2—8 cm; branches du premier ordre nombreuses, longues, plus ou moins distiques, avec des branches du deuxième ordre seulement aux sommets extrêmes, le plus souvent il y a des cicatrices des branches du deuxième ordre inférieures; branches du deuxième ordre distiques ou émises en tous sens; plumules larges, d'une largeur de 5—15 mm.

f. **gracilis** nov. f.; laxa, 1½—7 cm longa, axibus principalibus tenuibus, ramulis primariis et secundariis distantibus, ad axem incurvatis, superioribus alternis; plumuli acutissimi, angusti, ± 3 mm lati.

f. **elongata** nov. f.; aeneo-viridis, laxa, valde elongata, 7—18 cm longa, 1 cm crassa, ramulis primariis et secundariis saepe longissimis, primariis numerosis, haud regulariter in eodem plano, tertiariis distantibus, chromatophoris elongatis, ad 50 μ longis.

Parmi les espèces de *Bryopsis* déjà décrites un certain nombre devrait sans aucun doute être réduit à des synonymes des espèces traitées ici. Cependant seule la comparaison avec les types peut donner la certitude exigée. Aussi est-il préférable de ne pas prendre une limitation trop restreinte de l'espèce dans ce genre variable. *Bryopsis penicillata* Kütz. (Tab. Phyc. VI (1856) 28, T. 78, fig. II) n'est pas la même espèce que *Bryopsis penicillata* Suhr (une forme de *Bryopsis plumosa* (Huds.) Ag.), mais peut-être est-ce une forme de *Bryopsis Balbisiana* Lamour., bien que les branches du premier ordre soient émises en tous sens. Hamel ((1930) 64) a probablement raison en supposant que *Bryopsis duplex* de Not. (in Giorn. Bot. Ital. (1844) 320) est une forme plus fine de *Bryopsis Balbisiana*. *Bryopsis thuyoides* Kütz. (Tab. Phyc. VI (1856) 28, T. 78, fig. I), dont le type est conservé dans le Rijksherbarium à Leyde, est une forme fort ramifiée de *Bryopsis Balbisiana*. *Bryopsis hypnoides* Lamour. (in Journ. de Bot. II (1809) 135) est une forme peu compacte avec des branches allongées, émises en tous sens et des plumules non-triangulaires et irréguliers. Newton (1931) aussi bien que Taylor (1937), qui énumèrent comme les seules espèces se trouvant en Grande Bretagne et sur la côte nord-est de l'Amérique du Nord, *Bryopsis hypnoides* et *Bryopsis plumosa*, les distinguent entre elles par les branches distiques ou émises en tous sens. La valeur dubieuse de ce caractère se manifeste dans les exemplaires de *Bryopsis plumosa* de l'habitat n° 6 dans laquelle on trouve des branches du deuxième ordre distiques et émises en tous sens sur la même plante. Hamel (1930) aussi mentionne, que parfois les rameaux de *Bryopsis plumosa* sont émis en tous sens. Oltmanns (1922), lui aussi, indique que les branches distiques et émises en tous sens peuvent alterner dans la même espèce, ce qu'il attribue au milieu. Cette supposition n'est pas confirmée par les observations présentes, parce que dans l'habitat n° 10 *Bryopsis plumosa* f. *typica* avec des branches distiques et f. *gracilis* avec des branches émises en tous sens croissent pêle-mêle. Kützing (Sp. Alg. (1849) 493) a transplanté l'espèce *Bryopsis hypnoides* Lamour. à *Bryopsis plumosa* (Huds.) Ag. *β hypnoides* Kütz. ce qui semble juste. *Bryopsis plumosa* f. *gracilis* se rapproche de f. *hypnoides* (Lamour.) Kütz., dont elle diffère en ce que les branches ne sont pas allongées et que les plumules, quoique étroits, sont triangulaires et point irréguliers.

Le nombre d'espèces de *Bryopsis* trouvées par Funk (1927) dans le Golfe de Naples est de huit. En dehors des trois espèces, dont il s'agit ci-dessus, il énumère: *Bryopsis cupressoides* Lam., *Bryopsis*

penicillata Kütz., *Bryopsis Halymeniae* Berth., *Bryopsis Penicillum* Menegh. et *Bryopsis monoica* Berth. Les exemplaires que Funk compte parmi *Bryopsis cupressoides* Lamour. (incorrect d'après la nomenclature, selon Feldmann l. c. (1937) 224) dans l'herbarium de la Station zoologique de Naples sont des formes très ramifiées de *Bryopsis plumosa* (Huds.) Ag. f. *typica*. Les formes appartenant à *Bryopsis penicillata* Kütz. d'après Funk font peut-être partie de *Bryopsis Balbisiana* Lamour. Les trois espèces restantes sont des formes épiphytes minuscules, que je n'ai pas eu l'occasion d'étudier précisément à cause du matériel rare dans l'herbarium.

Aperçu des trois espèces étudiées:

Bryopsis Balbisiana Lamour.: cellule allongée, dichotomique ou non, avec peu de branches distiques au sommet ou sans branches.

Bryopsis muscosa Lamour.: parfois dichotomique; branches du premier ordre nombreuses, serrées, émises en tous sens.

Bryopsis plumosa (Huds.) Ag.: rarement dichotomique, branches du premier ordre avec des branches du deuxième et troisième ordre, le plus souvent distiques, moins souvent émises en tous sens.

La ramification dichotomique peut se manifester dans toutes les trois espèces, mais elle est rare dans *Bryopsis plumosa*. Les branches du deuxième ordre sont normales dans *Bryopsis plumosa* et anormales dans *Bryopsis Balbisiana* et dans *Bryopsis muscosa*. Des branches émises en tous sens se trouvent normalement dans *Bryopsis muscosa* et parfois aux branches supérieures dans *Bryopsis plumosa*. Des rhizoides, émis de la base des branches peuvent se presser fortement à l'axe principal à la manière d'une écorce. Ce caractère est normal chez *Bryopsis corticans* Setchell, l'espèce la moins rare de l'Amérique du Nord (Smith, 1938), et même il a donné le nom à l'espèce. Il semble donc évident que tous ces caractères peuvent se manifester dans toutes les espèces de *Bryopsis* quoique en fréquence et dans des combinaisons diverses.

Quoique Funk (1927) indique pour le temps de la fructification de *Bryopsis* surtout avril et mai et Feldmann (1937) toute l'année, je n'ai trouvé qu'une fois des plantes d'un *Bryopsis* portant des gamétanges. C'était *Bryopsis plumosa*. La reproduction végétative est beaucoup plus fréquente, surtout dans des circonstances défavorables. Quant l'axe principal est mort, les branches se détachent et peuvent former ensuite une plante nouvelle. Des formes de régénération ne sont pas rares, après que des *Gastéropodes Nudibranches* ont détruit des

parties de l'algue. Surtout *Hermaea dendritica* ALD. et HANC.[1]) fut trouvé plusieurs fois sur *Bryopsis muscosa* et *Bryopsis plumosa.* Ce *Gastéropode* a des papilles de la même couleur vert-mousse que les *Bryopsis,* ce qui le rend à peine visible. Un examen microscopique a indiqué qu'il y a des chromatophores arrondis dans les papilles. Dépouillé de *Bryopsis Hermaea dendritica* devenait pâle. A l'état captif *Aplysia* spec. s'est montré aussi capable de se nourir de *Bryopsis. Placida viridis* TRINCHESE [1]) vivant selon l'auteur sur *Bryopsis* ne fut trouvé qu'une fois sur une végétation de ce genre. Selon FUNK il arrive que des champs entiers de *Bryopsis* ont été détruits par les *Gastéropodes.* Probablement elles se nourrissent de toutes les espèces de *Bryopsis.*

5. ECOLOGIE.

a. *Ecologie spécifique.*

Bryopsis Balbisiana LAMOUR. croît sur les habitats étudiés au niveau de la marée basse, atteint rarement 20 cm plus haut, mais se trouve souvent plus bas jusqu'à 2½ m de profondeur. Il est toujours arrosé par l'eau marine, demande généralement peu de lumière solaire directe, vu qu'il la reçoit le plus souvent de l'Est ou du Nord-Est, moins souvent de l'Ouest et très rarement du Sud-Est ou bien il ne reçoit guère de lumière solaire directe, quand l'habitat est exposé au Nord. Quant à la limpidité de l'eau cette espèce n'est pas très exigeante, vu qu'on la trouve dans de l'eau sale ou même très sale, bien qu'elle préfère l'eau limpide. Elle croît le plus souvent dans de l'eau presque stagnante, quelquefois dans de l'eau peu agitée et rarement dans de l'eau très agitée, sur tuf ou sur des coquilles de moules et d'huîtres ou sur des balanes et aussi sur *Pterocladia capillacea,* quelquefois sur une pente à peu près perpendiculaire ou sur une pente faible. Occasionnellement *Bryopsis Balbisiana* forme une ceinture.

Bryopsis muscosa LAMOUR. croît sur les habitats étudiés au niveau de la marée basse ou un peu plus haut (au maximum 20 cm) et se trouve toujours arrosé par l'eau marine. Il reçoit la lumière solaire directe le plus souvent du Sud-Est ou de l'Est et moins souvent du Nord-Est ou de l'Ouest et semble donc demander assez de lumière solaire directe. Cette espèce croît sur tuf aussi bien que sur des coquilles de moules et de patelles et sur des balanes, dans de l'eau

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[1]) Dr. H. ENGEL (Mus. zool. à Amsterdam) à Naples à la même époque eut l'amabilité de bien vouloir identifier les *Nudibranches.*

limpide, assez agitée à très agitée (rarement moins agitée), aussi bien sur une pente à peu près perpendiculaire que sur une pente faible et sur un plan horizontal. La formation d'une ceinture est fréquente.

Bryopsis plumosa (HUDS.) AG. f. **typica** croît sur les habitats étudiés le plus souvent au-dessous du niveau de la marée basse et descend jusqu'à 2½ m de profondeur, rarement elle monte plus haut que le niveau de la marée basse. Cette forme semble peu exigeante quant à la quantité de lumière solaire directe, vu qu'elle la reçoit du Nord, du Nord-Est, du Sud-Est (mais alors à une profondeur de 1½ m) ou de l'Ouest. Elle se trouve généralement dans de l'eau sale à très sale, rarement limpide, dans de l'eau presque stagnante et jamais très agitée. Elle croît sur tuf, sur des coquilles d'huîtres ou sur des algues (*Caulerpa prolifera, Pterocladia capillacea, Gelidium pusillum*), quelquefois contre un mur vertical.

Bryopsis plumosa (HUDS.) AG. f. **elongata** KOSTER a été trouvée au niveau de la marée basse jusqu'à une profondeur de ± 1½ m et reçoit la lumière solaire directe du Nord-Est ou du Sud, quand elle vit à une profondeur de 1½ m. Elle croît dans de l'eau presque stagnante, assez limpide ou bien sale, sur tuf et sur des coquilles de moules et sur des balanes.

Bryopsis plumosa (HUDS.) AG. f. **adriatica** (J. AG.) HAUCK croît un peu plus haut que le niveau de la marée basse ou à ce niveau, mais elle est toujours arrosée par l'eau marine. Elle reçoit peu à assez de lumière solaire directe du Nord-Est, de l'Est ou du Sud-Est, elle vit dans de l'eau limpide, presque stagnante à très agitée, sur tuf, aussi sur une pierre plate et horizontale.

Bryopsis plumosa (HUDS.) AG. f. **gracilis** KOSTER n'a été trouvée qu'à un seul endroit à une profondeur de ½—1 m à marée basse, sur un fond de tuf et sans lumière solaire directe (l'habitat exposé au Nord) dans de l'eau limpide et presque stagnante.

Bryopsis plumosa (HUDS.) AG. f. **penicillata** (SUHR) KOSTER a été trouvée toujours un peu au-dessus du niveau de la marée basse, bien que toujours arrosée par l'eau marine. Elle demande peu à assez de lumière solaire directe, vu qu'elle la reçoit du Nord-Est, de l'Est ou du Sud-Est. Elle vit toujours dans de l'eau limpide, agitée peu à beaucoup et se trouve sur tuf; elle a été trouvée sur une pierre plate et horizontale.

C'est BERTHOLD (1882), qui le premier étudia minutieusement une végétation algale en relation avec les facteurs écologiques. Dans le Golfe de Naples la différence entre marée basse et marée haute n'est

selon lui pas de plus de 30—50 cm, de sorte que les marées n'y ont que peu d'importance. Il n'y a pas de courants constants dans le Golfe intérieur. Funk (1927) indique une température de 15—19° C pour le niveau de l'eau marine aux mois d'avril—mai. Wendicke (1916) a constaté une température de 22½° C à une profondeur de 0—2 m au commencement de juin. La température diminue à mesure que la profondeur augmente. La salinité est à peine influencée par l'affluence de l'eau douce dans le Golfe de Naples; elle augmente avec la profondeur tout près de la côte (Wendicke).

Funk (1927) est de l'opinion que les *Bryopsis* ne peuvent pas supporter l'eau sale du port et que ce genre ne peut pas vivre plus haut que le niveau de la mer. Les résultats actuellement obtenus ne confirment pas la première supposition, mais bien la seconde. Les *Bryopsis* ne peuvent jamais dessécher dans ses habitats.

Wendicke (1916) indique que l'eau du Golfe de Naples est saturée d'oxygène jusqu'à une profondeur de 10 m; à une plus grande profondeur elle en est sursaturée. L'agitation de l'eau est d'une immense importance pour la respiration des algues marines selon Gessner (1940). Il a constaté que la respiration s'affaiblit beaucoup dans l'eau stagnante, tandis qu'elle est intensifiée dans l'eau agitée.

En rapport avec les facteurs écologiques importants dans le Golfe de Naples, notamment la profondeur, l'émersion, l'exposition, l'agitation de l'eau et le substratum, on trouve des différences spécifiques dans les *Bryopsis*. *Bryopsis muscosa* Lamour. a un habitat bien déterminé; il croît toujours au niveau de la marée basse. Il préfère l'eau très agitée, ce qui correspond aux observations de Funk (1927), de Hamel (1930) et de Feldmann (1937). Cette espèce ne vit pas comme épiphyte. Elle a besoin de beaucoup de lumière solaire directe et d'une grande limpidité de l'eau. *Bryopsis Balbisiana* Lamour. croît sur les habitats étudiés dans de l'eau sale et presque stagnante, ce qui correspond à l'observation de Funk (1927). Feldmann (1937) au contraire a trouvé cette espèce dans les stations de la mer assez battues sur la côte des Albères. Il préfère moins de lumière solaire directe que l'espèce précédente. Il a été trouvé comme épiphyte comme *Bryopsis plumosa* (Huds.) Ag. et il croît aussi au-dessous du niveau de la marée basse. Les formes de *Bryopsis plumosa* semblent préférer chacune des facteurs écologiques un peu différents. *Bryopsis plumosa* (Huds.) Ag. f. *penicillata* (Suhr) Koster et f. *adriatica* (J. Ag.) Hauck vivent dans de l'eau limpide, plus ou moins fortement agitée, et reçoivent assez de lumière solaire directe, tandis que les autres formes vivent

dans de l'eau presque stagnante et. f. *gracilis* KOSTER exceptée, dans de l'eau assez sale. Le substratum est le même pour les trois espèces.

b. *Résistance contre l'eau marine diluée et concentrée.*

A propos d'un article de BIEBL (1938), dans lequel il étudie e. a. la résistance des *Rhodophycées* contre l'eau marine diluée et concentrée, quelques investigations ont été faites. La conclusion suivante de l'article de BIEBL est surtout intéressante: les limites de résistance des mêmes algues sont constantes dans des océans différents, ce qui montre qu'il s'agit de caractères héréditaires du protoplasme d'une espèce (ce que HÖFLER (1931) présumait déjà).

Deux fois on a apporté à l'auteur de l'eau du Golfe de Naples aussi pure que possible. La salinité de l'échantillon du 8 mai était de 3,69 %, du 24 mai elle était de 3,04 % [1]. WENDICKE (1916) trouva au commencement de juin à une profondeur de 0—2 m une salinité de 3,75 %.

Des touffes de *Bryopsis* furent mises pendant quelques heures dans des flacons de verre, hauts de ± 10 cm et de ± 5 cm de diamètre. BIEBL laissa ses algues pendant 24 heures dans les flacons et il se servit de petits fragments de thallus. L'expérience avec *Bryopsis* dura 16—23 heures et comme une plante de *Bryopsis* se compose d'une seule cellule, il n'est pas possible de se servir d'un fragment; au contraire il faut se garder de l'endommager. Les solutions, dans lesquelles les *Bryopsis* ont été mis, ont été obtenues en diluant de l'aqua destillata dans de l'eau marine ou en concentrant l'eau marine. Elles varient d'aqua dest. à une solution de 2½ × la salinité de l'eau marine. Elles varient entre elles de ½ × la salinité de l'eau marine. Des résultats extrêmement précis ne sont jamais possibles avec cette méthode. En effet, quoique les plantes avant d'être mises dans la solution d'eau marine aient été séchées avec du papier buvard, il est impossible de défaire le *Bryopsis* d'une certaine quantité de l'eau marine, dans laquelle on l'a pris.

Quand une plante de *Bryopsis* meurt, les chromatophores s'arrondissent et s'accumulent, le protoplaste se trouble, quelquefois il devient réticulaire et il se brise.

BIEBL (1938) a trouvé qu'il n'y a pas d'algue marine, qui puisse

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[1]) Mes remerciements cordiaux à Melle le Dr M. F. E. NICOLAI (Lab. bot. à Leyde) et au Dr J. VERWEY (Stat. zool. à den Helder), qui tous deux ont déterminé plus tard la salinité.

supporter un séjour de 24 heures dans l'eau douce. Les trois espèces de *Bryopsis* étudiées ne font pas exception. Höfler (1931) suppose que la résistance contre l'eau marine diluée et concentrée est plutôt déterminée par l'héridité que par le milieu.

Les investigations présentes montrent que *Bryopsis plumosa* f. *gracilis* a les limites de résistance les plus distantes, quant à la salinité, qui est de ½ × à peine jusqu'à 2½ × la salinité de l'eau marine [1]), ce qui est de 1 × à peine jusqu'à 2 × pour f. *typica*, de 1 × jusqu'à 2 × pour *Bryopsis muscosa* et seulement de 1 × jusqu'à 1½ × pour *Bryopsis Balbisiana*. Il est intéressant, que Biebl (1937) ait trouvé que cette valeur est de 0,8 × jusqu'à 1,4 × pour *Nithophyllum punctatum*, une *Rhodophycée*, qui est fréquente dans l'association de *Bryopsis Balbisiana*. Cette *Rhodophycée* ne semble pas se trouver dans l'association à laquelle appartient *Bryopsis muscosa*.

On sait que la concentration de l'eau marine, qui cause la plasmolyse est mortelle pour presque toutes les *Rhodophycées* (Kylin, Höfler, Biebl). Cependant, *Bryopsis plumosa* f. *typica* de Palazzo Donn'Anna après avoir été mise dans une solution de 2 × la salinité de l'eau marine pendant 18 heures, ce qui causait la plasmolyse, et après 26 heures dans de l'eau marine, avait des parties avec des chromatophores arrondis (morts), mais d'autres parties avec des chromatophores normaux. *Bryopsis Balbisiana* de Villa da Luca était tout à fait mort après la même expérience. *Bryopsis plumosa* f. *gracilis* de Palazzo Donn'Anna fut mise dans une solution de 2½ × salinité de l'eau marine pendant 21½ heures; plus tard elle fut mise dans de l'eau marine courante pendant 11 heures. La plasmolyse, visible après 5 minutes dans la solution concentrée, avait disparu après les 11 heures dans l'eau marine et les plantes avaient un aspect normal. *Bryopsis Balbisiana* ne montrait après la même expérience qu'un axe principal normal, tandis que les branches étaient partiellement vides et avaient pour le reste des masses de chromatophores morts. Donc, non seulement que la résistance contre l'eau marine diluée et concentrée est plus grande chez *Bryopsis plumosa* que chez *Bryopsis Balbisiana*, mais aussi l'espèce première se rétablit dans l'eau marine après avoir été mise dans une solution concentrée.

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[1]) Ce résultat est en concordance avec celui, trouvé par Biebl (1939) pour les algues littorales, qui est de 0,3 × jusqu'à 2 × la salinité de l'eau marine.

Résistance contre l'eau

habitats et espèces.	aqua destillata.	½ × la salinité de l'eau marine.
Posillipo, Villa da Luca. (habitat ensoleillé). 18 hrs: 8 V/18.15—9 V/12.15 *Br. Balbisiana*, 2 échantillons, conduite tout à fait semblable.	l'eau est devenue verte, le protoplasme est troublé, s'est détaché de la cloison et s'est agglutiné, les chromatophores sont arrondis et presque décolorés; la plante est flasque; *mort.*	
Posillipo, Palazzo Donn'Anna. (habitat ombragé). 18 hrs: 8 V/18.15—9 V/12.15 *Br. plumosa* f. *typica*, 2 échantillons, conduite tout à fait semblable.	id.; *mort.*	
Mergellina, port, ± 1½ m de profondeur, sur un bateau ancré. 22 hrs: 10 V/12.30—11 V/10.30 *Br. plumosa* f. *typica*.	id.; *mort.*	l'eau est devenue un peu verte; les chromatophores sont arrondis, moins décolorés que les précédents; la plante est flasque; *mort.*
Posillipo, Pensione Martinelli, ± 1 m de profondeur, au niveau de la marée basse. 20 hrs: 16 V/14.00—17 V/10.00 *Br. Balbisiana*, avec des branches du premier ordre.	id.: *mort.*	axes principaux vides; chromatophores arrondis; *mort.*
Br. muscosa.	id.; *mort.*	chromatophores normaux; protoplasme réticulé et troublé; *mort.*

arine diluée et concentrée.

eau marine, salinité de 3,69 %.	1½ × la salinité de l'eau marine.	2 × la salinité de l'eau marine.
tout à fait normal; *vivant.*		plasmolyse intense dans les axes principaux et les branches; chromatophores normaux; *peut-être pas tout à fait mort.*
id.; *vivant.*		plasmolyse partielle dans les axes principaux et les branches; chromatophores en partie normaux, en partie arrondis; *partiellement vivant.*
d.; *vivant.*	plasmolyse dans l'axe principal, protoplaste rompu; chromatophores normaux; *partiellement vivant.*	comme dans 1½ × la salinité de l'eau marine; *partiellement vivant.*
hromatophores arrondis; *mort* (cas anormal).	la plupart des axes principaux normaux; chromatophores normaux; *vivant.*	les axes principaux en partie vides, en partie plasmolysées; dans les branches encore quelques chromatophores normaux; *mourant.*
out à fait normal; *ivant.*	tout à fait normal; *vivant.*	chromatophores et branches normaux; plasmolyse dans l'axe principal; *partiellement, si non entièrement vivant.*

habitats et espèces.	½ × la salinité de l'eau marine.	eau marine, salinité de 3,04 %
Posillipo, Pensione Martinelli. 16 hrs: 24 V/18.15—25 V/10.15 *Br. Balbisiana,* 1 m de profondeur.	chromatophores dans les branches normaux, dans les axes principaux arrondis et agglutinés; axes principaux partiellement vides; *presque mort.*	tout à fait normal; *vivant.*
Br. muscosa, au niveau de la marée basse, sur une pierre de tuf.	id.; *presque mort.*	id.; *vivant.*
Posillipo, Palazzo Donn'Anna. 21½ hrs: 26 V/12.45—27 V/10.15 *Br. Balbisiana,* peu compacte, avec des branches du premier ordre.	chromatophores arrondis, protoplaste réticulé; *mort.*	id.; *vivant.*
Br. plumosa f. *gracilis.*	la plupart des chromatophores normaux, quelques-uns arrondis, pour le reste normal; *encore vivant.*	id.; *vivant.*
Posillipo, Palazzo Donn'Anna. 23 hrs: 30 V/11.15—31 V/10.15 *Br. Balbisiana,* dichotomique ou non, sans branches du premier ordre.	chromatophores arrondis, agglutinés, protoplaste rompu; *mort.*	id.; *vivant.*
Br. Balbisiana, dichotomique, avec des branches du premier ordre.	id.; *mort.*	id.; *vivant.*

½ × la salinité de l'eau marine.	2 × la salinité de l'eau marine.	2½ × la salinité de l'eau marine.
out à fait normal; *ivant.*	axe principal partiellement normal, partiellement vide; chromatophores arrondis, agglutinés, commencement de plasmolyse dans les branches, mais chromatophores normaux; *mourant.*	protoplaste contracté partout; *mort.*
l.; *ivant.*	chromatophores et branches normaux, plasmolyse violente dans les axes principaux; *vivant.*	id.; *mort.*
l.; *ivant.*	chromatophores normaux, ça et là agglutinés, protoplasme partiellement troublé dans l'axe principal; commencement de plasmolyse; *partiellement vivant.*	id.; *mort.*
l.; *ivant.*	chromatophores normaux, commencement de plasmolyse; *vivant.*	plasmolyse, protoplaste rompu en plusieurs endroits; chromatophores normaux; *mourant*
..; *ivant.*	chromatophores arrondis, agglutinés; *mort.*	chromatophores arrondis et agglutinés, quoique normaux dans quelques parties de l'axe principal; protoplaste rompu; *mort ou mourant.*
.; *vant.*	id.; *mort.*	chromatophores arrondis et agglutinés; protoplaste rompu; *mort.*

6. EPIPHYTES SUR BRYOPSIS.

Le plus grand nombre d'épiphytes se trouvent sur les *Bryopsis* dans l'eau la moins agitée. FUNK (1927) ainsi que FELDMANN (1937) eurent le même résultat de leurs investigations. Les *Bryopsis* sont plus riches en épiphytes que les autres algues de la même association. Seulement les espèces de *Cladophora* y égalent les *Bryopsis* en richesse en ce qui concerne les épiphytes. Elles ont la forme filamenteuse et ramifiée ainsi que la couleur verte en commun avec les *Bryopsis*. Dans le Golfe de Naples les *Rhodophycées* filiformes portent peu d'épiphytes. Les épiphytes les plus ordinaires appartiennent aux *Diatomées*, aux *Bangiales* et aux *Cyanophycées*.

Bryopsis Balbisiana porte le plus grand nombre d'épiphytes des trois espèces de *Bryopsis* étudiées. La relation avec l'habitat est évidente: il vit dans de l'eau presque stagnante. Les épiphytes suivants ont été trouvés sur cette espèce: un grand nombre de *Diatomées* (hab. n° 14, 15, 20, 22), couvrant de temps en temps presque l'axe principal entier, *Erythrocladia subintegra* ROSENVINGE (hab. n° 14), *Erythrotrichia ciliaris* (CARMICH.) THUR. (hab. n° 14, 15), *Goniotrichum Alsidii* (ZANARD.) HOWE (syn. *Goniotrichum elegans* (CHAUVIN) LE JOL.) (hab. n° 14), *Ceramium rubrum* (HUDS.) AG. (hab. n°. 14), *Griffithsia furcellata* J. AG. (= *Neomonospora furcellata* (J. AG.) FELDMANN-MAZOYER) (hab. n° 20), *Polysiphonia variegata* (AG.) ZANARD., *Callithamnion* spec. (hab. n° 14), *Cladophora utriculosa* KÜTZ. (hab. n° 20), *Dermocarpa minima* GEITLER (hab. n° 19).

Bryopsis muscosa, qui croît dans de l'eau très agitée, porte le plus petit nombre d'épiphytes des trois espèces de *Bryopsis* étudiées. Sur cette espèce ont été trouvés: *Erythrocladia subintegra* ROSENVINGE (hab. n° 12) et *Entocladia viridis* REINKE (hab. n° 2, 12).

Sur *Bryopsis plumosa* les épiphytes suivants ont été trouvés: des *Diatomées* (hab. n° 6, 16), *Erythrocladia subintegra* ROSENVINGE (hab. n° 7), *Entocladia viridis* REINKE (hab. n° 7), *Dermocarpa minima* GEITLER (hab. n° 7).

Parmi les *Bangiales Erythrotrichia ciliaris* (CARMICH.) THUR. est sans aucun doute une espèce, qui a soulevé bien des problèmes. Les phases initiales et plus ou moins avancées ont été considérés comme des espèces séparées, de sorte qu'il y a un assez grand nombre de synonymes. Ce sont: *Erythrotrichia ciliaris* (CARMICH.) THUR. in LE JOLIS Alg. Mar. Cherbourg (1863) 103 — *Bangia ciliaris* CARMICH. in HOOK. Brit. Fl. II (1833) 316; HARV. Phyc. Brit. IV (1846—1851) T. 322 — *Porphyra bangiaeformis* KÜTZ. Spec. Alg. (1849) 691; KÜTZ.

Tab. Phyc. XIX (1869) 29, T. 79 a—d (ex icone, non quoad herb. Kützing) — *Erythrotrichia discigera* Berth. in Fauna u. Flora Neapel (1882) 25, T. I, fig. 15—18; Dangeard in Botaniste Sér. 24 (1932) 146, Pl. XVII; Feldmann in Rev. Algol. XI (1939) 252 — *Erythropeltis discigera* (Berth.) Schmitz in Engl. Prantl Nat. Pflanz. Fam. I, 2 (1897) 313, fig. 195 — *Erythrotrichia ciliaris* (Carmich.) Batt. in Journ. of Bot. 38 (1900) 374 (d'après la description les cellules sont plus grandes); Feldmann in Rev. Algol. XI (1939) 253, fig. 1—2 — prob. *Erythrotrichia polymorpha* Howe in Mem. Torrey Bot. Club XV (1914) 77—81, Pl. 29 (le disque basal devient occasionnellement très grand) — Fig. 3.

Quant au nom de cette espèce c'est *Erythrotrichia ciliaris* (Carmich.) Thur., qui est le nom valable. La conception de Thuret sur l'espèce ne serait-elle pas juste, que ce serait quand même lui qui, le premier, a fait la combinaison nouvelle.

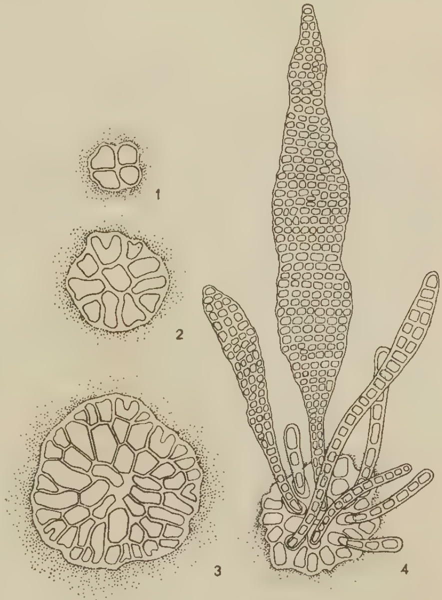

Fig. 3 — *Erythrotrichia ciliaris* (Carmich.) Thur.: 1–3. disques sans filaments; 4. disques avec des filaments dressés composés de 1—8 rangées de cellules, × 500.

L'espèce polymorphe se compose de disques monostromatiques à peu près orbiculaires, composés de une à un grand nombre de cellules. Les cellules sont irrégulièrement anguleuses, les extérieures sont souvent allongées, souvent bifides, longues de 8—16 μ, larges de 4—6 μ. Les cellules ont une couleur rouge-carmin, ou violet sale, ou des cellules des deux couleurs se trouvent dans le même disque. Ces disques peuvent rester ainsi, mais souvent il y a des filaments dressés, provenant surtout des cellules centrales. Ces filaments longs jusqu'à ± 1 mm sont composés d'une rangée de une à plusieurs cellules. Plus haut ils se composent souvent de deux, quatre on huit rangées de cellules. Toutes les

phases du thalle ne se rencontrent pas toujours sur la même plante de *Bryopsis*.

La distribution géographique est naturellement incomplètement connue. L'espèce a été trouvée jusqu'à ce moment sur les côtes atlantiques de l'Ecosse et de la France, sur les côtes de la Méditerranée et probablement au Pérou. Elle est toujours épiphyte.

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MISCELLANEOUS NOTES ON LORANTHACEAE, 25

by

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(Issued February 8, 1941)

Macrosolen urceolatus DANSER, n. sp. — Omnis glabra. Caules (2 suppetunt) graciles, ad 55 cm longi et ultra (supra basin decerpti), internodiis teretibus, inferioribus 2.5—6 cm longis, ad 4 mm diametro, superioribus plerumque paulo brevioribus, gradatim tenuioribus, ad 1.5 mm diametro, nodis vetustioribus incrassatis nonnihil applanatis, ad sesquiplo crassioribus quam internodia, iunioribus applanatis et dilatatis. Folia opposita vel subopposita; petiolus 3—8 mm longus, basi subteres, 1.5—1.75 mm latus, versus laminam paulum dilalatus et applanatus, subtus rotundatus, supra fere planus; lamina ovato-lanceolata, 5—12 cm longa, 1.5—4 cm lata, sub basi cuneata in petiolum contracta, apicem obtusum vel subobtusum versus leviter acuminata, margine saepe irregularis, nonnihil flavida (in herbario), utrinque opaca vel facie superiore nonnihil lucida, inferiore punctulis minimis atris numerosis, nervatura pinnata, costa facie superiore distincta usque ad apicem, plana sed saepe nonnihil prominula, facie inferiore a basi ad apicem gradatim minus prominens, saepe subcarinata, nervis lateralibus et venis utrinque visibilibus, facie inferiore distinctioribus quam superiore. Inflorescentiae racemosae pedunculatae, singulae vel binae vel ternae in axillis foliorum adultorum (nunquam in axillis foliorum rudimentariorum quae passim inveniuntur inter folia normalia); axes in scrobiculis corticis inserti, involucris nullis, basi nonnihil incrassati, caeterum subteretes, a basi circiter 1 mm crassa ad apicem c. 0.3 mm crassum sensim attenuati, 10—25 mm longi, pedunculo 3—10 mm longo, saepe nonnullis insertionibus et bractea singula sterilibus, parte florifera paribus florum 2 ad 5, nodis paulum dilatatis; pedicelli teretes, plerumque 2—3 mm longi, 0.25 mm crassi, basi in annulum incrassati; bracteae, ut bracteolae paulo minores, ellipticae, 0.75 —1 mm longae, obtusae vel acutae, basi paulum connatae vel liberae, leviter concavae. Calyx urceolatus, supra partem inferiorem ellipsoidem circiter 1.5 mm longam 1 mm

latam distincte contractus, deinde in partem superiorem infundibuliformem circiter 0.5 mm longam integerrimam ampliatus, parte libera autem brevissima. Corolla statu alabastri adulti ad 33 mm longa, supra basin rotundatam partibus $^2/_3$ inferioribus late tubulosa vel magis inflata, ad 4 mm lata, ad apicem partis ampliatae alis 6, deinde contracta in collum 6-angulum lateribus cavis, 1.5 mm diametro, apice incrassata in clavam obovatam 6-angulam lateribus cavis costisque obtusis; denique divisa in lacinias 6 recurvas usque ad medias alas. Filamenta circiter 7 mm longa, antherae c. 2 mm longae, obtusae. Stylus corollae subaequilongus, circiter 1 mm supra basin articulatus, parte basali persistente versus basin cum disco 6-tuberculato connata supra 6-angula, deinde teres usque ad partem in collum inclusam ibique ad dimidiam crassitudinem attenuatus, in 2 mm superioribus iterum incrassatus, apice stigmate subgloboso, c. 0.8 mm diametro. Fructus ignotus.

This *Macrosolen* is perhaps conspecific with *M. tenuiflorus* DANSER, which is likewise from East Borneo (Kong Kemoel), but the specimen described here differs by longer corollas and stamens, non-oviformous style-base, and narrow leaves. According to the description it is apparently also very near *M. javanus*, but it is distinct by different shape, colour, and consistency of the leaves, the lack of black parts on the corolla, smaller bracts, and urceolate calyx.

Specimen described (*type*): East Borneo, Kahajan Regions, Bahaoen, 25 IX 1938, VAN WIJK 65-a (intermingled with VAN WIJK 65, in the Buitenzorg Herbarium); vern. name: *toengkoen* (Kahajan language).

THE BRITISH-INDIAN SPECIES OF VISCUM REVISED

and compared with those of South-Eastern Asia, Malaysia, and Australia,

by

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(Issued February 8th, 1941)

When revising the *Visca* of the Malay Archipelago and Indo-China, I met with some nomenclatorial difficulties, for which a more thorough study of the British-Indian *Visca* seemed necessary. The distinction of the species in HOOKER's Flora soon appeared not to be depended upon. At the time of HOOKER's revising the British-Indian *Loranthaceae*, only a scanty quantity of herbarium was available, and, the distinction between several species being extremely difficult, it is no wonder that HOOKER's treatment of *Viscum* is no more up to date now. As appears from notes on herbarium sheets, GAMBLE later made a rather thorough study of the British-Indian *Visca*, which was only partly included in his Madras Flora, but he did not include the species of adjacent countries in his study. We now have a much larger quantity of herbarium materials at our disposal; several species described from outside British-India appeared to occur inside its frontiers, and new species had to be described from British India and China. Therefore a critical revision of all the Asiatic species seemed not to be superfluous. Moreover, the close relationship of the Australian *Visca* with Asiatic species made it desirable to include also the former in this revision. A revision of all the Asiatic, Malaysian, and Australian *Visca* would therefore have been the result, if not political circumstances had rendered it impossible to obtain the materials of several important Herbaria in the Tropics. I therefore preferred to close my study on the genus *Viscum* provisorily, and to publish it in the present form, in expectation of better times.

The Herbaria upon which the present revision is based, mainly are those of Kew Gardens (K), and the Dehra Dun Forest Experiment Station (DD), the *Viscum* materials of which were kindly sent to me for examination. Many data, however, could be added from other

Herbaria, such as those of Buitenzorg (B), Berlin-Dahlem (BD), the British Museum of Natural History (BM), Berkeley (UC), Brisbane (Bris), Edinburg (E), Geneva (G), Göteborg (Göt), Groningen (Gro), Honolulu (H), Leiden (L), Manila (M), Paris (P), Shillong (Sh), Singapore (S), and Vienna (V).

On the arrangement of the species of Viscum by Korthals, Van Tieghem, and Engler.

The first author who made an attempt at giving a natural subdivision of *Viscum*, was Korthals, who, in 1839 (Verhand. Batav. Genootsch., 17, 235—236) distinguished 4 sections:

1. *Viscum verum*; dioecious species; type: *V. album.*

2. *Ploionuxia*; monoecious species, which have the male and female flowers surrounded by a boat-shaped bracteal cup, composed of a pair of connate bracts; type: *V. orientale*, *i. e.*, our *Viscum ovalifolium.*

3. *Aspiduxia*; like the preceding section, but leafless, the bracteal cup moreover shield-shaped; type: *V. articulatum.*

4. *Baratostachys*, American species with the flowers in spikes; type: *V. torulosum*, nowadays *Phoradendron torulosum*. When discussing *Viscum geminatum* (p. 259, nowadays *Korthalsella geminata*), Korthals remarks that this species, according to its inflorescences, should be placed in the latter section.

If we bear in mind that, apart from the European *V. album*, Korthals only knew a limited number of Asiatic species, and a few American ones that nowadays have been removed into other genera, there is no denying that Korthals had some feeling for a natural subdivision.

In 1896, Van Tieghem gave another subdivision of *Viscum* (Bull. Soc. Bot. Fr., 43, 187—193). Instead of one genus he distinguished two: *Viscum* (p. 187) and *Aspidixia* (p. 191), the latter based on Korthals' section *Aspiduxia*. When discussing his new genus, Van Tieghem also critically considered Korthals' subdivision, making remarks about it that are not quite correct. He says (*l. c.*, p. 191):

"En 1839, Korthals a réparti, comme on sait, les diverses espèces de *Viscum* de l'Ancien Monde connues de lui entre trois sections, savoir: *Viscum verum*, pour les espèces feuillées à inflorescence terminale et dioïque, dont le type est le *V. album* L.; *Ploionixia*, pour les espèces feuillées à inflorescence latérale et monoïque, dont le type est *V. orientale* Willd.; *Aspidixia*, pour les espèces aphylles dont le type

est le *V. articulatum* Burm. Ce sectionnement a été admis par tous les auteurs qui ont suivi, même les plus récents, comme Bentham et Hooker, en 1883, et M. Engler, en 1889 et en 1895."

"Il ne paraît pas cependant pouvoir être conservé. D'abord toutes les fois qu'un *Viscum* a ses fleurs en triade, les deux bractées de la triade s'écartent de la fleur médiane pour loger les deux fleurs latérales et ensemble prennent cette forme de nacelle qu'exprime le mot *Ploionixia*; les *Viscum verum*, ou *Euviscum*, sont donc, eux aussi, des *Ploionixia*. Toutes les fois, au contraire, qu'un *Viscum* a la fleur solitaire, les deux bractées sous-florales demeurent appliquées autour de la base de la fleur, qu'elles enveloppent d'une sorte de cupule ou de bouclier, d'où le nom d'*Aspidixia*. Par là, cette troisième section paraît donc se séparer nettement des deux premières. Mais Korthals a rendu cette séparation moins nette en n'y admettant que des espèces aphylles et en retenant dans la section *Ploionixia* les espèces feuillées qui ont la même inflorescence. Il a sacrifié ainsi à une commodité plus grande la valeur scientifique de son sectionnement. C'est pourquoi on a cru devoir plus haut réunir dans le genre *Viscum* les *Viscum verum* de Korthals et la plupart de ses *Ploionixia*, en pratiquant d'après d'autres considérations le sectionnement de ce genre ainsi réduit."

"Si maintenant on croit devoir conserver, en l'érigeant à l'état de genre autonome, la section *Aspidixia* de Korthals, c'est en lui donnant une extension plus grande et en y introduisant toutes les espèces, feuillées ou non, qui ont la fleur solitaire à base enveloppée par une cupule de deux bractées." &c.

From what I cited from KORTHALS, it is evident that this author has not at all "sacrifié à une commodité plus grande la valeur scientifique de son sectionnement". The fact that, in his section *Aspiduxia*, he did not include leafy species, was merely caused by the circumstance, that he did not know leafy monoecious species with inflorescences like that of *Viscum articulatum*.

VAN TIEGHEM, who knew that the particularities of the inflorescences are independent of the development of the leaves, rightly preferred to base his distinctions of genera and sections upon the former. Yet he did this in an incorrect way, as, in the first place, he described *Aspidixia* as not having triads, but single flowers. A simple examination of the inflorescences of *Viscum articulatum*, *V. nepalense*, *V. liquidambaricolum*, *V. angulatum*, *V. ramosissimum*, and *V. mysorense*, clearly shows that these species also have their flowers in triads, only with the middle flower sustended by a bracteal cup of its own. If one

prefers to denote these inflorescences by another names as "triads", one must also give this other name to the female inflorescences of *V. album* and its allies, which have the middle flower sustended by its own bracteal cup as well; the more so, as these inflorescences are often more than 3-flowered. The case, however, of *Viscum album*, which has the inflorescences 1 -5-flowered, and usually the apical flower with bracteal cup in the female plant, without bracteal cup in the male plant, clearly shows that VAN TIEGHEM's distinction between the *Visca* with flowers in triads and those with flowers single, is an artificial one.

VAN TIEGHEM's subdivision of his genus *Viscum* is as follows (cfr. l. c., p. 189).

I. Les triades sont à la fois terminales et axillaires, ce qui rend la ramification dichotomique; il y a en même temps dioecie et les fleurs mâles sont grosses . . . . Sect. 1. *Euviscum*.
II. Les triades sont exclusivement axillaires, ce qui rend la ramification latérale; il y a en même temps presque toujours monoecie et les fleurs mâles sont petites.
   1. Dans chaque triade les fleurs sont de même sorte, mâles dans les unes, femelles dans les autres; espèces en majorité monoïques, quelquefois dioïques . . . . Sect. 2. *Isanthemum*.
   2. Dans chaque triade les fleurs sont de deux sortes.
      a. La fleur médiane est mâle et les latérales femelles . . . . Sect. 3. *Mesandrum*.
      b. La fleur médiane est femelle et les latérales mâles . . . . Sect. 4. *Mesogynum*.

This subdivision is not correct in all parts either. The distinctive characters between the first and the second section have not been exactly expressed, since in the first the inflorescences are mainly terminal, but also lateral, in the second mainly lateral, but exceptionally also terminal. Moreover the terms lateral and terminal express a difference of degree only. *V. orbiculatum* and *V. verruculosum* (both synonyms of *V. heyneanum* in this paper) do not belong to the section *Isanthemum*, but to *Mesogynum*, since the middle flowers of their cymes are, as a rule, female. None of the Asiatic *Visca*, known to the present author, belongs to *Isanthemum*.

The third and last subdivision of *Viscum* we owe to ENGLER (Pflanzenfam., Nachtr., 1897, p. 140), but it does not offer new points of view. ENGLER, rightly, again unites *Aspidixia* with *Viscum*, and then gives a subdivision which is mainly a combination of those given by VAN TIEGHEM for his two genera. ENGLER, however, follows VAN TIEGHEM too closely in all details, even in his errors. ENGLER again

distinguishes between the species with flowers in triads and those with single flowers; to *V. album* he ascribes triads only; the subsections *Ploionixia* and *Aspidixia* of his section *Botryoviscum* are distinguished by him by means of the structure of the inflorescences: to the former he ascribes mainly triads, to the latter mainly single flowers; all these errors have been taken from VAN TIEGHEM. Like VAN TIEGHEM, ENGLER mentions *V. orbiculatum* and *V. verruculosum* as belonging to *Isanthemum*, and he adds to these, likewise erroneously, *V. ramosissimum*. In the second edition of the Pflanzenfamilien, in vol. 16b, p. 196—203, the same subdivision of *Viscum* is met with unaltered.

It is impossible to me to give a criticism in full of VAN TIEGHEM's and ENGLER's subdivisions, as the bulk of the species of this genus is African, and has not been examined by me. In the Flora of Tropical Africa 26 species are enumerated, in the Flora Capensis 20 species, in the Catalogue des Plantes de Madagascar 44 species, and only few of these are common to two of the three regions mentioned. As little is it possible to give a system of the Asiatic species only. But to give as natural an arrangement as possible of the species accounted for in this paper, has been attempted in the following.

It is clear that the grade of development of the leaves cannot be the base for a natural arrangement of the species. The leafless *Viscum nudum* is most closely related to the leafy *Viscum album*; the leafy *V. mysorense* is most closely related to the leafless *V. articulatum* and its allies; the leafless *V. Bancrofti* is most closely allied to the leafy *V. Whitei, V. capitellatum,* and *V. trilobatum*. It is, however, possible to distinguish more natural groups on the ground of the structure of the inflorescence, and it is therefore that the following arrangement is proposed here.

I. No adventicious flowers in the cymes.
   A. Flowers in spikes with terminal flower, which are usually 1—5-flowered, and the terminal flower of which, if female, usually has a bracteal cup of its own.
      1. Flowering part of the plant with terminal inflorescences on the apex of all internodes. Moreover lateral inflorescences or not. Dioecious species.
         a. Leafy: 1. *V. album*, 2. *V. Alni-formosanae*, 3. *V. Fargesii*, 5. *V. cruciatum*.
         b. Leafless: 4. *V. nudum*.
      2. Flowering part of the plant exceptionally (*i. e.* on the extremities of weak branchlets) with terminal inflorescences, usually with numerous lateral inflorescences only. Monoecious species.

a. Leafy: 6. *V. mysorense.*

b. Leafless: 7. *V. articulatum*, 8. *V. nepalense*, 9. *V. liquidambaricolum*, 10. *V. angulatum*, 11. *V. ramosissimum*; probably also: 12. *V. Loranthi.*

B. Spikes reduced to triads with the middle flower female, the lateral flowers male. All leafy: 13. *V. ovalifolium*, 14. *V. Wrayi*, 15. *V. Acaciae*; probably also: 16. *V. indosinense.*

II. Inflorescences enlarged by the development of adventicious flowers.

A. Middle flower of the cymes female. All leafy: 17. *V. orientale*, 18. *V. heyneanum*, 19. *V. monoicum*, 20. *V. multinerve.*

B. Middle flower of the cymes male.

a. Leafy: 21. *V. trilobatum*, 22. *V. capitellatum*, 23. *V. Whitei.*

b. Leafless: 24. *V. Bancrofti.*

Artificial key to the species.

1. Leafy 2
   Leafless 14
2. In the flowering part of the plant terminal inflorescences on all internodes, and ramification from the adjacent axils, hence a regular dichotomy . . 3
   In the flowering part of the plant only exceptionally terminal inflorescences, hence no regular dichotomy 5
3. Plant in its lower portion with several decussate pairs of leaves on each branch, dichotomously branched at all nodes towards the extremities. Female cymes with no more than 3 flowers, the central one of which usually sessile. Fruits stipitate. Male flowers large, with tepals 6—8 mm long . . . . **5. V. cruciatum**
   Plant dichotomously branched from the base. Female cymes 3—5-flowered, the central flower shortly pedicelled, the lateral ones in 1 or 2 decussate pairs. Fruits not stipitate. Male flowers smaller, tepals 2—3 mm long or even smaller 4
4. Leaves linear . . . . **3. V. Fargesii**
   Leaves lanceolate to obovate . . . . **1. V. album**
   Cfr. also the little different . . . . **2. V. Alni-formosanae**
5. Cymes with no more than 1 female and 2 male flowers 6
   Cymes with more than 3 flowers and more than one female flower . . 9
6. Fruits, with exception of the very young and entirely ripe ones, warty . . . . **13. V. ovalifolium**
   Fruits dull by minute granules, but not warty . . . **14. V. indosinense**
   Fruits smooth and shining 7
7. Fruits not stipitate. Central flower of each cyme sustended by a bracteal cup of its own. Leaves partly normally developed, partly reduced to scales . . . . **6. V. mysorense**
   Fruits stipitate. Central flower of the triads without a bracteal cup of its own. Leaves normally developed on nearly all the nodes 8
8. Internodes gradually flattened towards the apex. Leaves nearly obovate . . . . **14. V. Wrayi**
   Internodes not flattened, very slender. Leaves lanceolate to spathulate . . . . **15. V. Acaciae**

9. Unripe fruits with warts or papillae . . . . **18. V. heyneanum**
Unripe fruits dull by minute granules, but not warty. Cymes often with more than one internode . . . . **17. V. orientale**
Unripe fruits smooth and shining in all stages 10
10. Fruits strongly stipitate. Plant very slender. Leaves with 5—9 longitudinal nerves . . . . **20. V. multinerve**
Fruits oblong, attenuate towards the base and the apex. . . . . **18. V. heyneanum** var. **liocarpum**
Fruits attenuate only at the base, or contracted only below the tepal-bearing margin 11
11. Fruits oblong, not attenuate nor contracted at the apex, rather truncate. Central flower of the cymes female. Leaves with 3—7, usually 5, longitudinal nerves, acute or obtuse . . . . **19. V. monoicum**
Fruits roundish, often contracted below the tepal-bearing margin. Middle flower of the cymes male 12
12. Leaves lanceolate, acute. Stems very slender . . . . . **23. V. Whitei**
Leaves broader, very obtuse or truncate. Stems stiff, divaricately branched 13
13. Leaves roundish to cuneate, 1.5—4.5 cm long, 1—4 cm broad. Peduncles of cymes 0—2 mm long . . . . **21. V. trilobatum**
Leaves 1.5—2 cm long, concave upwards. Peduncles of cymes 2—10 mm long . . . . **22. V. capitellatum**
14. Flowering plant with terminal inflorescences on all internodes, branching from the adjacent axils, hence regularly dichotomous. Female inflorescences 3-flowered, the central flower sustended by its own bracteal cup . . . . **4. V. nudum**
Flowering plant only exceptionally with terminal inflorescences and dichotomously branched 15
15. Tepals persistent on the fruit, growing out with it. Plant stiff, divaricately branched; all parts with a granular, nearly papillose, dull-shimmering surface . . . . **12. V. Loranthi**
Petals deciduous, or only persistent in the dry state. More slender plants . 16
16. Inflorescences with a male central flower without bracteal cup of its own, and moreover 2—4 female flowers within the common bracteal cup . . . . **24. V. Bancrofti**
Inflorescences with a female central flower with its own bracteal cup, and moreover usually 2 lateral male flowers 17
17. Flowering stems with the internodes distinctly flattened 18
Flowering stems with the internodes not or only hardly flattened . . 20
18. Internodes slender, usually not more than 5 mm broad. Fruits white or greenish-white, globose, not more than 3 mm in diameter. Nearly always parasitic on *Loranthaceae* . . . . **7. V. articulatum**
Fruits darker-coloured, and also larger, or at least longer. Only now and then on *Loranthaceae* 19
19. Internodes 5—10 mm broad. Fruits globose or somewhat oblong in the unripe stage . . . . **8. V. nepalense**
Internodes usually 3—5 mm broad. Fruits oblong. Usually parasitic on *Quercus, Castanea*, or *Liquidambar* . . . . **9. V. liquidambaricolum**

20. Flowering stems with terete internodes, often grooved or striped, but not 4-angular . . . . **11. V. ramosissimum**
Flowering stems with distinctly 4-angular internodes . . **10. V. angulatum**

1. Viscum album LINNAEUS, Spec. plant., ed. 1 (1753) II, 1023; THUNBERG, Fl. jap. (1784) 63; KORTHALS, in Verhand. Batav. Genootsch., 17 (1839) 254; LEDEBOUR, Fl. ross., II, 1 (1844) 380; MAXIMOWICZ, Primit. Fl. Amur. (1859) 134; BUHSE, in Nouv. Mém. Soc. Nat. Mosc., 12 (1860) 105; WYDLER, in Flora, 43 (1860) 443; MIQUEL, Annales, 3 (1867) 133; BRANDIS, Forest Fl. N.W. & Centr. India (1874) 392; FRANCHET & SAVATIER, Enum. plant. jap., 1 (1875) 406; MAXIMOWICZ, in Mélang. Biol. Acad. Sc. Pétersb., 9 (1877) 615; KURZ, Forest Fl. Burma, 2 (1877) 323, excl. var. *karensium*?; EICHLER, Blüthendiagr., 2 (1878) 553; BOISSIER, Fl. orient., 4 (1879) 1068; AITCHISON, in Journ. Linn. Soc., bot., 18, no. 106 107 (1880) 92, p.p.; BENTHAM & HOOKER FIL., Gen. pl., III, 1 (1880) 213; HOOKER FIL., Fl. Br. Ind., V, 13 (1886) 223; SCHÖNLAND, in Ann. Bot., 2 (1888) 283 seq., t. 17; LOEW, in Bot. Zeit., 48 (1890) 565 seq.; LINDMAN, in Bot. Centralbl., 44 (1890) 241 seq.; FORBES & HEMSLEY, in Journ. Linn. Soc., bot., 26, no. 177 (1894) 407; HEMSLEY, in Journ. Linn. Soc., bot., 31 (1896) 307; VAN TIEGHEM, in Bull. Soc. Bot. Fr., 43 (1896) 173; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., Nachtr. (1897) 140; GAMBLE, Ind. timb. (1902) 583; COLLETT, Fl. simlens. (1902) 440; BRANDIS, Ind. trees (1906) 552; LECOMTE, in SARGENT, Pl. Wilson., 3 (1916) 318; LÉVEILLÉ, Cat. pl. Yun-Nan (1916) 285; TUBEUF, Monogr. Mistel (1923) 1 seq.; PARKER, For. Fl. Punjab (1924) 441; FISCHER, in Rec. Bot. Surv. Ind., XI, 1 (1926) 160 seq.; OSMASTON, For. Fl. Kumaon (1927) 465; HANDEL-MAZZETTI, Symbol. sin., VII, 1 (1929) 160; DINSMORE, in POST, Fl. Syria, Palest. & Sinai, ed. 2, 2 (1933) 486; ENGLER & KRAUSE, in ENGL., Nat. Pflanzenfam., ed. 2, 16b (1935) 199; DANSER, in Blumea, II, 2 (1936) 55; in Bull. Jard. Bot. Buitenzorg, sér. 3, XVI, 1 (1938) 58; *Viscum dichotomum* GILIBERT, Exercit., 2 (1792) 394; *Viscum stellatum* D. DON, Prodr. fl. nepal. (1825) 142; A. P. DE CANDOLLE, Prodr., 4 (1830) 278; G. DON, Gen. Hist. Dichl. Pl., 3 (1834) 403; KORTHALS, in Verhand. Batav. Genootsch., 17 (1839) 254; BENTHAM & HOOKER FIL., Gen. pl., III, 1 (1880) 213; ? *Viscum karensium* VAN TIEGHEM, in Bull. Soc. Bot. Fr., 43 (1896) 189; *Viscum Aitchisoni* VAN TIEGHEM, ibidem, 190, nom. nud., p.p.; *Viscum album* var. *typicum* & var. *rubro-aurantiacum* MAKINO, in Bot. Mag. Tokyo, 18 (1904) 67; *Viscum costatum* GAMBLE, in Kew Bull. 1913 (1913) 46; *Viscum album* ssp. *coloratum* KOMAROV, Fl. Mansh.,

2 (......) 107, non visum; NAKAI, Fl. koreana, 2 (1911) 179; *Viscum coloratum* NAKAI, in MORI, Enum. pl. corean. (1922) 128.

Stems dichotomously or umbellately branched from the base, the number of branches at each node usually 2—6, rarely up to 13; internodes cylindrical, swollen at the nodes, the thickest ones up to 10 mm or more in diameter, the terminal flowering ones 0.5—2.5 mm in diameter, all of them green (without cork nor lenticels), wrinkled in the dried state, each internode with two lateral scales (prophylls) at its base and two, rarely three, normal leaves at its apex. *Leaves* lanceolate or elliptic to obovate-lanceolate or obovate, usually obtuse in the narrow-leaved, rounded in the broad-leaved forms, always strongly narrowed towards the base, sessile or subsessile, usually 25—100 mm long, 5—35 mm broad, thin- or thick-coriaceous (more or less succulent in the fresh state), little different above and below, curvinervous or flabellinervous with 3—9 longitudinal indistinct or distinct nerves, which in the latter case are somewhat more distinct above than below and connected by indistinct reticulate veins. *Inflorescences* terminal on the articulations of the stem, between the pairs of normal leaves and in the bifurcations of the stems, but also on articulations that are more or less reduced to pedunculate cymes, and in that case the cymes to 2—6 laterally inserted on the nodes and with leaves more or less reduced to bracts. Flowers dioecious. Male inflorescence nearly always 3-flowered, with a terminal flower subtended by a pair of bracts decussate with the leaves, and each bearing one male flower in its axil, below these a peduncle 0—3 mm long; female inflorescence usually 3—5-flowered, with a terminal flower subtended (perhaps not always) by a pair of bracts not bearing flowers in their axils, below these one or two decussate pairs of bracts bearing flowers in their axils; the bracts sometimes roundish and short, sometimes longer and more triangular, decussate with the leaves and with each other; below these a peduncle 0—2 mm long. *Male flowers* roundish in bud, nearly 2 mm in diameter, with 4 valvate lobes and a very short tube. *Female flowers* considerably smaller than the male ones, with a short-cylindrical ovary, crowned by 4 thickish, triangular tepals nearly 0.5 mm long, and a short nipple-shaped or short-cylindrical style. *Fruits* globose or roundish-elliptical, up to 4—8 mm long, 4—7 mm in diameter, probably larger in the fresh state. (Description from the British Indian plants of the Kew and Dehra Dun Herbaria.)

Remarks If we begin by considering the Indian forms of *Viscum album*, we may remark that, in the Himalaya, the species is

rather polymorphous. We cannot be surprised at this if only we keep in mind that already in Europe, which is so much nearer to the periphery of the total area, *V. album* is remarkably polymorphous. It seems, however, impossible to distinguish among the Himalayan forms any distinct varieties. Though we often meet with remarkable forms which are sufficiently different to be considered even as species, these forms are connected by so many intermediates, and their geographic distribution is so little characteristic, that even their distinction as varieties seems useless. The variability affects all the parts of the plant, *e. g.* the dimensions and mode of ramification of the stems, the dimensions, shape, texture, and nervation of the leaves, the numbers of flowers in the inflorescences, and the development of additional inflorescences beside the terminal ones. From the labels it is not evident whether in the Himalaya there exists any important variability in the colour of the ripe fruits, as is the case in more eastern regions.

In which way the stems may be divided into two to six branches at their nodes, is exactly described and explained by EICHLER (*l. c.*). WYDLER observed more numerous branches (up to 12), as I did in the Himalaya materials, and once I found 13 branches at the apex of an internode. That the branches, originating from the apex of the same internode, are usually very unequally developed, is described by all morphologists dealing with the subject (EICHLER, WYDLER, SCHÖNLAND, LINDMAN, *ll. cc.*, and others). At the apices of the weakest branches the leaves are often reduced to bracts, and in that case *Viscum album*, though characterised by its terminal inflorescences, moreover bears so-called lateral inflorescences, which are, in general, characteristic for other species. Among the Asiatic specimens I never met with stems which, on one twig generation, had more than one pair of normal leaves, as is characteristic for *V. cruciatum*. WYDLER, however, describes such instances (*l. c.*) for European plants.

The leaves of *V. album* show a high degree of variability in their dimensions, *viz.*, from 25 to 100 m in length by 5 to 35 mm in width; also the shape may be very different, varying from obtuse-lanceolate to broadely cuneate-obovate. The nervation is sometimes entirely indistinct, in other cases more or less distinct, and often very distinct on both sides. The number of longitudinal nerves is usually 3, but varies up to 9.

As regards the structure, the inflorescence is as EICHLER describes it, *viz.*, 3-flowered, with the two lateral flowers sessile in the axils of opposite bracts, the middle flower shortly pedicelled between them, and

sustended by its own pair of bracts if female, without such if male. Exceptions to this rule are, however, numerous. As in herbaria male plants are by some unknown cause much less numerous than female ones, we can say little about their variability. On the female plants we often meet with 5-flowered inflorescences, consisting of two decussate pairs of sessile lateral flowers, and one terminal flower, either with or without its own pair of bracts; the lateral flowers never bear prophylls. Inflorescences with more than 3 flowers are also described by LINDMAN and WYDLER (*ll. cc.*), other aberrations from the most common type by SCHÖNLAND (*l. c.*). I once met with a so-called lateral inflorescence bearing in the axils of its involucral bracts again the same type of inflorescences.

It is a remarkable fact, that *V. album* is not found throughout the Himalayan tract; it is common from Afghanistan to the Nepal frontier, but much rarer more to the East. From Nepal I did not see more than a single specimen, of which the exact locality is not given, but *V. album* certainly occurs there, because D. DON's *V. stellatum*, described from Nepal, undoubtedly represents the same species. Here, however, the southern boundary of the common form of *V. album* seems to run in N.E. direction. In Sikkim, however, the species reappears in a peculiar form, which is also spread in Assam, Burma, Yunnan, and even in Tonkin. This form appears to be a geographic variety, readily distinguishable in herbaria. GAMBLE's *Viscum costatum* may be included in it, but is my no means characteristic for it; moreover, the leaves of the type specimen are rather strongly bullate between the main nerves, and consequently costate beneath, but this peculiarity is not found in other specimens of the variety, and hardly in any of the species. It is therefore, that I have not based my var. *meridianum* on GAMBLE's type specimen of his *V. costatum*, nor used his specific name for the new variety.

If we now look at the common form of the species, we find it back in northern and north-eastern China, Korea, the Amur Basin, Japan, and Formosa. In China the polymorphy is still important, but in Japan and Formosa it decreases, and the plants from these countries are, in the herbarium, not distinguishable from the European forms. At the same time, however, there appears a remarkable variability as regards the fruit colour, the ripe fruits being white, yellowish, golden-yellow, orange, or red. Upon the red-fruited form of Manshuria, KOMAROV seems to have based a new subspecies, which also occurs in Japan and Formosa, and was elevated to

specific rank by NAKAI. The fruit colour, however, seems to be the only distinctive character of this so-called species, because no additional characters are mentioned, and in the herbaria it appears to be entirely like the white-fruited variety. MAXIMOWICZ (*l. c.*) mentions specimens with light greenish-yellow fruits from Japan, specimens with golden-yellow fruits from Manshuria.

Of the further varieties found among the Chinese herbarium materials, I must mention a slender form with remarkably narrow leaves, occurring here and there in the Himalaya, but more frequently in China, and which perhaps may be considered as an approach towards *Viscum Fargesii*. It is represented by the numbers DRUMMOND 23862, from the Himalaya, and LICENT 6056 and 6057, FORBES s.n., and HU 1110, all from China. Though, on one hand, it is connected with other forms of *V. album* by so many intermediates, that it seems useless to give it a varietal name, it does, on the other hand, not really connect *V. Fargesii* with *V. album*.

A doubtful name is *Viscum karensium* VAN TIEGHEM, in Bull. Soc. Bot. Fr., 43 (1896) 189, a *nomen nudum*, enumerated by VAN TIEGHEM after *Viscum album* among the "diverses espèces voisines, considérées par beaucoup d'auteurs comme n'en étant que de simples variétés", and therefore undoubtedly the same as *Viscum album* var. *karensium* KURZ, For. Fl. Burma, 2 (1877) 324. The latter variety is described by KURZ in the following way: "inflorescence shorter or longer peduncled; perianth lobes 3; involucre smaller and narrower"; whereas *V. album proper* is described as follows: "inflorescence more robust, sessile or nearly so; perianth lobes 4; involucre larger and broader". The var. *karensium* is said to be "not unfrequent in the dryer hill forests of the Martaban hills, at 5,000 to 6,000 ft elevation".

I have seen no specimens, and from the description it is not clear what kind of plant KURZ means. It is not a *Viscum* at all? Or perhaps *V. album* var. *meridianum* DANSER, described as new in this paper?

For the interpretation of VAN TIEGHEM's *Viscum Aitchisoni*, based upon AITCHISON's *V. album*, see *V. cruciatum*.

Specimens examined:

ORIENT. Asia Minor. Dardanelles, SINTENIS 230 (K) ♂; Kurkuteli, 1000 m, TENGWALL 523 (K) ♂; Holy Land, Gamala, HAYNE s. n. (K) ♀; Southern Syria, Mt. Hermon, 6000 ft, LOWNE s. n. (K) ♀; Northern Persia, Ghilon, AUCHER-ELOY 4642, 4643 (K) ♀; prov. Asterabad, Bender Ges, FREYN 1414 (K) ♀.

INDIA. Without exact locality: JACQUEMONT 667 (K) ♀; "N. W. India", ROYLE s. n. (K) ♂; N. W. Himalaya, 5–7,000 ft, THOMSON s. n. (K); "Bendeoot", FALCONER s. n. (K); Afghanistan, Bharowul, GRIFFITH 1372 = Kew Distribution

2736 **(K)** ♂; Kurram Valley, Zeran Tangi, HARSUKH 15549 (DD, K) ♀; Kurram Valley, base of the Péwárkotal, Turai, AITCHISON 87 (DD, K) ♀; N. W. Frontier Prov., Nathia, DEANE s. n. (K) ♀; Samana Range, HARE s. n. (DD) ♀; Chitral, Laram, 7000 ft, GATACRE 17526 (DD) ♀; Hazara, DUTHIE s. n. (K) ♀; Punjab, DRUMMOND 23862 (K) ♀; Tandiani or thereabout, DRUMMOND 21985 coll. BARRETT 75 (K) ♂, ♀; dry hills above Dooah (?), 5—6,000 ft, DRUMMOND 21492 (K) ♀; Parhatti Valley, Kulu, Jhari, 5300 ft, PARKINSON 3906 (DD) ♀; Kangra, SAHNI 49 (K) ♀; Kashmir, Chamba, between Kulel and Tisa, 4000 ft, GAMMIE 18220 (DD, K) ♀; Eismakhan, 6500 ft, CLARKE 31186 (K) ♀; Kamraj, Huni, 5000 ft, FULLER s. n. (DD); Simla, FIELDING s. n. (K); MADDEN s. n. (K); DALHOUSIE s. n. (K); 5—7,000 ft, EDGEWORTH 195 (K) ♂; Kothi, Mahasur (?), COLLETT s. n. (K) ♀; Naldehra, 6500 ft, GAMBLE 4393 (DD, K) ♀; Sima, below Koti, GAMBLE 6269 (DD, K) ♀; Kumaon, JAMESEN s. n. (K); THOMSON 1058 (K) ♀; Barun (?), 4—5,000 ft, RAMSUKH 8016 (DD) ♀; Gungoli (?), 5500 ft, STRACHEY and WINTERBOTTOM 2 (K) ♀; Bashahr State, Danglu, 8000 ft, KARTAR SINGH 52 (DD) ♂, ♀; Naini Tal Division, HIRA SINGH 78 (DD) ♂, ♀; Tihri Garhwal, Lambatach (?), 7000 ft, GAMBLE 26738 (K) ♀; Kollich, 7000 ft, GAMBLE 26768 (K); Garhwal, 4—6,000 ft, STEWART 595 (K) ♀, "on *Alnus* and *Crataegus*"; Lohbsa, 5500 ft, OSMASTON 253 (DD) ♀; Jaunsar, RAMSUKH s. n. (DD) ♀; Kathian, 7000 ft, GAMBLE 21474 (DD, K) ♀; 6800 ft, KANJILAL 1057 (DD); 7—8,000 ft, DUTHIE 13012 (DD) ♀; Kotikanasar, 6000 ft, PARKINSON 7037 (DD) ♀; Nepal, WALLICH Catal. 490 (K) ♀.

CHINA. Kansu province, N. E., E. LICENT 6056, 6057 (K) ♀; between Choni and Lanchow, 2600—3000 m, CHING 1044 (BD) ♀, on *Populus, Ulmus, Acer,* fruit greenish-yellow; Kiangsi Prov., An Yüan Hsien, 2300 ft, HU 1110 (BD, K) ♀, on *Pterocarya,* white berries; Hupeh Prov., A. HENRY 7883 (K) ♀; Ichang, WILSON s. n. (K) ♀, on *Pterocarya,* berries greenish-yellow; Shantung Prov., Chefoo, FORBES s. n. (K) ♀; Chili Prov., Peking, BUSHELL s. n. (K) ♀; LIU L. 303 (K) ♀; Wuchang, PURDOM 64 (K); Tchang-Ting-Fou, CHANET 1001 (K) ♂; Jehol, DAVID 1706 (K) ♀; Shung-king Prov., between Mukden and Tung-she-shien, JAMES s. n. (K); Jaoling, ROSS 389 (K), "both red and yellow berries"; Manshuria, STUART s. n. (K) ♀; "ad flumen Ussuri", coll. ? s. n. (K) ♀.

AMUR PROVINCE. MAXIMOWICZ s. n. (DD, K) ♀; near Chabrovsk, on the Amur, KOMARÒV 522 (K) ♀, *type* (?) of the ssp. *coloratum* KOMARÒV.

JAPAN. Korea, Prov. Kogen, Kongo-san, 1000 m, WILSON 10522 (K), "*V. coloratum* NAKAI, on *Quercus mongolica,* rare"; *ibidem,* round Mutiuzi, WILSON 9289 (K), "*V. coloratum* NAK.", on *Quercus mongolica*; Prov. N. Heian, around Maban (Musan), 833 m. WILSON 8709 (K), "*V. coloratum,* on *Quercus mongolica*"; Quelpart Island, Seiki-ho, to Mushroom House, WILSON 9576 (K) ♀, "*V. coloratum* NAKAI", fruit orange-red; from Mushroom House near Sopa to Monastery, WILSON 9581 (K) ♀ "fruit greenish-white, on *Quercus glandulifera,* common"; Hokkaido, Sapporo, INAGAKI s. n. (Gro, L) "*Viscum coloratum* NAKAI; Sapporo Plain, FAURIE 6809 (K); Hakodate, MAXIMOWICZ s. n. (K) ♀; Hondo, WILSON 7765, 7766 (K) ♀, "*var. rubro-aurantiacum* MAKINO"; Hondo, Hirosaki, FAURIE 1253, 1254 (K) ♂, ♀, on *Alnus*; Fuji-yama, TSCHONOSKI s. n. (B, K); Fuji-yama, OLDHAM 270 (K) ♀; Nikko, sine coll. & num. (K); Yokoska, SAVATIER 553 (K) ♂; Prov. Musashi, Nippara, H. TAKEDA s. n. (K) ♀, "*Viscum album var. rubro-aurantiacum* MAKINO";

Formosa, Dagelet Island, Oo-njong-too, WILSON 8583 (K) ♀, "*Viscum coloratum* NAK., common on *Fagus multinervis*, not seen on any other tree".

Viscum album var. **meridianum** DANSER, nov. var. — Folia obovato-cuneata, late rotundata, in herbario conspicue nervosa nervis longitudinalibus 3—9, ut caules plerumque luteola.

INDIA. Sikkim, THOMSON s.n. (DD) ♀; Darjeeling, the Shrubbery, 7000 ft, GAMBLE 711 (K) ♀, *type* of *Viscum costatum* GAMBLE; Assam, Naga Hills, Japu Forests, DE 17461 (Sh), *type* of the *var. meridianum* DANSER; Burma, Southern Shan States, Kalaw protected area, ROGERS 694 coll. WRIGHT (DD), on *Salix*.

CHINA. Yunnan, Shweli-Salwin Divide, Lat. 25°45′ N., Long. 98°58′ E., 9000 ft, FORREST 25388 (BD, E, K) ♀, fruits pale green.

FRENCH INDO-CHINA. Tonkin, Laokay Prov., forêt de Chapa, BRILLET s.n. (P) ♀.

2. **Viscum Alni-formosanae** HAYATA, Ic. pl. Formos., 6 (1916) 39, ic. 3.

I have not seen a type of this, but the under-mentioned specimen is from Formosa and has been found growing on *Alnus formosana*. It is a male plant, which very much resembles *Viscum album*, and which could very well be a form of this. The stems are slender, somewhat thickened at the nodes, somewhat longitudinally wrinkled, the longest lids 8.5 cm long by 2.5 mm in diameter. The leaves are very dull, ovate with attenuate base, obtuse, and therefore calling to mind those of *Viscum orientale*, with 3—5 longitudinal ribs, the largest ones 4.5—5 cm long (the petioles incl.), 15—18 mm broad. The inflorescences are terminal on the youngest articulations, and here and there lateral on the older nodes; their structure is as in *Viscum album*, though it often occurs that the middle flower of the triad is surrounded at its base by an involucre of two bracts, as is usually the case in the female plant. On the specimens in the Kew Herbarium I counted 14 terminal inflorescences, all normally 3-flowered, and of which 9 had the middle flower sustended by 2 bracts, 2 not so, whereas 3 were doubtful in this respect; I found only one inflorescence axillary at the side of a terminal inflorescence, and this was normally 3-flowered and had no bracts below the middle flower; I counted 13 lateral inflorescences on older nodes, all of which were normally 3-flowered, 3 with 2 bracts at the base of the middle flower, 5 without such, and 5 doubtful in this respect; of these lateral inflorescences only one had one leaf-like involucral bract; more than 3 flowers were not found in any of the inflorescences.

HAYATA says that this species mainly differs from *V. album* "in

the male flowers which are usually in pair at the top of the branches, and in the much narrower perianth segments of the same flowers". These differences are absent in the specimens described above; the flowers are all in bud, and subglobose. HAYATA describes and figures the flowers as 3- or 4-merous, but I only found 4-merous flowers. As, however, the description of the stems and the leaves matches those of the above mentioned plant, I think it quite possible that our plant is specifically identical with HAYATA's after all.

Specimens examined: FORMOSA. Arisan Prov., Kagi, WILSON 9713 (K) ♂, "*Viscum Alni-formosanae* HAY. *on Alnus formosana*".

3. **Viscum Fargesii** Lecomte, Not. syst., 3, p. 173 (1915).

Stems terete, dichotomous at all nodes or here and there with more than two branches; lower internodes to 5 cm long by 2 mm in diameter, little thickened at the nodes, green, the terminal ones somewhat less thick, to 1 mm in diameter, and also somewhat shorter, to 3.5 cm long. *Leaves* opposite, sessile at the tip of the ramifications, linear, usually 2.5—3.5 cm long, 1—1.75 mm broad, rounded at the apex, attenuate towards the base, thickish, wrinkled, nerveless, often, however, smaller or even scale-like, only 1.5 mm long; all ramifications moreover with a pair of scales (prophylls) at their bases. *Inflorescences* as in *Viscum album*, only the female ones known, nearly 5 mm long, with a short axis bearing two alternate pairs of bracts, of which the lower ones bear single sessile flowers in their axils, and the upper ones enclose one flower. *Fruits* only known in the half-developed stage, nearly 4 mm long bij 3 mm in diameter, crowned by the nipple-shaped style. (Description from type specimens in the Buitenzorg and Kew Herbaria.)

Very much like a small, slender, and narrow-leaved form of *Viscum album*, but with a very peculiar appearance, and, as far as known, not connected with *V. album* by intermediate forms.

CHINA. Eastern Sze-chuan, Tchen-kéou-tin district, FARGES s. n. (B, K) ♀, apparently *types*.

4. **Viscum nudum** DANSER, n. sp. — Fruticulus foliis carens, omnino glaber, *Visco albo* defoliato similis. *Rami* multoties bifurcatim vel umbellatim ramosi; internodia teretia, nodis paulum tantum dilatatis neque incrassatis, vetustissima quae adsunt ad 7 cm longa, 6 mm diametro, superficie rugulosa, novissima circiter 1.5—2 cm longa, nonnihil applanata, 1.5 mm lata; rami omnes basi prophyllis 2 squami-

formibus appressis, apice foliis 2 squamiformibus patentibus, brevibus, latis, obtusis, circiter 0.5—0.75 mm longis, margine fimbriatis, denique nonnihil auctis et reflexis, passim ex internodiis 2 compositi, circa medium squamis 2 cum superioribus alternantibus. *Inflorescentiae* (femineae tantum notae) terminales in articulationibus novissimis et in bifurcationibus recentissimis, pedunculo brevi crasso circiter 2—3 mm longo et diametro, triflorae, flore singulo mediano breve pedicellato basi cupula e bracteis 2 composita stipato, floribus 2 lateralibus oppositis in axillis bractearum sessilibus. *Alabastra* iuvenilia minima et *fructus* immaturi globoso-ellipsoides circiter 4 mm longi 3 mm diametro adsunt. (Description from the type specimen WILSON 4483 in the Kew Herbarium.)

Remarks. The type specimen appears to be a female specimen of a dioecious species and looks like a leafless specimen of *Viscum album*. As more or less leafless forms of *V. album* are unknown, and there are a few more differences between our new form and the latter, I prefer to distinguish our plant as a new species. Most remarkable is the fact, that here and there the twig generations appear to be composed of two internodes, which is so extremely rare in *V. album* and so common in the allied *V. cruciatum*. Our specimen has very young flower buds, apparently for the next spring, and unripe fruits, apparently from the last winter. Lateral inflorescences are absent.

The other two specimens mentioned below were discovered afterwards; they confirmed my belief, that I had rightly distinguished a new species. These specimens show more frequently twig generations composed of two internodes. On the specimen SCHNEIDER 1449 I even found such twig generations bearing decussate axillary branches, and moreover a few 5-flowered inflorescences.

CHINA. West Sze-chuan, beyond Tatsien-lu, 9000 ft, WILSON 4483 (K) ♀, parasitic on *Populus* sp., *type* specimen; South Sze-chuan, between Oti and Ouentin, 2800 m, SCHNEIDER 1449 (BD) ♀; South Sze-chuan, between Humati and Woholo, 2000—4000 m, SCHNEIDER 3487 (BD) ♀.

5. **Viscum cruciatum** BOISSIER — *Viscum orientale* (non WILLDENOW) SPRENGEL, Syst. veg., 1 (1825) 488, p.p.; A. P. DE CANDOLLE, Prodr., 4 (1830) 278, p.p.; G. DON, Gen. Hist. Dichl. Pl., 3 (1834) 403, p.p.; *Viscum album* (non LINN.) WEBB, It. hisp. (1838) 42, n.v.; AITCHISON, in Journ. Linn. Soc., bot., 18, no. 106—107 (1880) 92, p.p.; *Viscum cruciatum* BOISSIER, Voy. Bot. Esp., 2 (1839—1845) 274;

WILLKOMM & LANGE, Prodr. Fl. Hisp., 1 (1870) 25; CHALON, Rev. Lor. (1870) 66; ETTINGSHAUSEN, in Denkschr. Akad. Wissensch. Wien, Mathem.-Naturwiss. Cl., 32 (1872) 58; WILLKOMM, Prodr. Fl. Hisp., supplem. (1893) 6; VAN TIEGHEM, in Bull. Soc. Bot. Fr., 43 (1896) 189, 243; BOISSIER, Fl. orient., 4 (1897) 1068; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., Nachtr. (1897) 140; HOOKER FIL., in Bot. Magaz., t. 7828 (1902); LÁZARO É IBIZA, Compend. Fl. Esp., ed. 2, 2 (1907) 65; TUBEUF, in Naturwiss. Zeitschr. Forst- & Landwirtsch., 6 (1908) 407 seq., 497 seq., ic. pp. 412, 498—501, 506; ASCHERS. & GRÄBNER, Synops. Mitteleur. Fl., 4, p. 670 (1912); TUBEUF, in Naturwiss. Zeitschr., 11 (1913) 151 seq., ic. 1—12; HANSEN, in KERNER, Pflanzenleben, ed. 2, 3 (1921) 321; TUBEUF, Monogr. Mistel (1923) 89, 94, 99, 769, 772, 784; ic. 10; ic. 112, 11 & 12; ic. 162; tab. 32, 33, 34; DINSMORE, in POST, Fl. Syria, Palest. & Sinai, ed. 2, 2 (1933) 486; *Viscum Willdenowianum* MOLKENBOER, in MIQUEL, Pl. Junghuhn., p. 108 (1852); *Viscum Aitchisoni* VAN TIEGHEM, in Bull. Soc. Bot. Fr., 43 (1896) 190, nomen, p.p.

Stems usually 20—25 cm long, once or twice branched in the basal portion, with decussate branches, which in their turn are several times dichotomously branched; internodes terete, with more or less wrinkled surface, the lower ones often longitudinally grooved, up to 5 cm long by 5 mm in diameter, but usually much shorter, 1—2 cm long, the upper ones gradually less thick, usually somewhat flattened towards the apex, down to 1 mm or even to 0.5 mm broad. *Leaves* opposite, sessile, lanceolate to elliptical or somewhat obovate, rounded at the apex, contracted at the base, the largest usually 4 cm long by 1.5 cm broad, rarely to 5 cm long bij 1.8 cm broad, most of them smaller, however, especially the upper ones, which usually are 15—30 mm long by 3—6 mm broad; thickish, without visible nerves or with 3 longitudinal nerves visible on both sides; all ramifications, inflorescences included, moreover with 2 scales (prophylls) at their bases. *Inflorescences* terminal in the bifurcations of the stems and lateral on all the nodes, up to 4 together, peduncled, the male ones usually 3-flowered with all the flowers sessile, but often reduced to the middle flower, the female ones always 3-flowered, with the middle flower either sessile like the lateral ones, or pedicelled, and in this case with an involucre of two small bracts at its base, the three flowers together always placed in a naviculate cup formed of two opposite acute bracts, together up to 2 mm long or rarely longer. Flowers dioecious. *Male flowers* in bud oblong-ovate, 6–8 mm long, 4-angular towards the tip, later divided into 4 lobes down to 1—2 mm above the base, the lobes

recurved in the upper half, covered on the inside, with exception of the margin, by the adnate anthers, which open with many pores. *Female flower* obovate, 1—2 mm long, composed of the large ovary and 4 triangular nearly 0.75 mm long tepals, which soon fall off, and a little prominent, nipple-shaped, persistent style. *Fruit* stipitate, with exception of the 1—2 mm long stipe globose, up to 5 mm in diameter. (Description from the specimens from Asia Minor in the Kew Herbarium.)

Remarks. Though *Viscum cruciatum* appears to be well-distinct from *Viscum album*, it is not always easy to distinguish it from the latter in all stages of development. It may therefore be remarked, that young specimens are characterised by all their parts being smaller, and especially by their twig generations being composed of more than one internode; flowering male plants are easily distinguished by their very large flowers; flowering female plants are characterised by the structure of their inflorescences, which are always 3-flowered with all the flowers sessile and the middle one without separate bracts, more rarely the middle one shortly pedicellate and with a small involucre of two small bracts. The fruit-bearing female plant is easily recognised by the smaller stipitate fruits, of which there are never more than 3 together in one bracteal cup.

To the synonyms the following must be remarked.

After WILLDENOW had, in 1805, based his *Viscum orientale* on plants from "India Orientalis", SIEBER collected plants of another species in Palestine (see the list of localities below) which he distributed under the name of *Viscum cruciatum* SIEBER. In 1825, SPRENGEL, in his Systema Vegetabilium, erroneously identified the latter with the former. In 1830, DE CANDOLLE, in his Prodromus, followed SPRENGEL in this respect, moreover including Javan plants, wrongly described by BLUME as *Viscum orientale* (see *V. ovalifolium*), in the same species. *Viscum cruciatum* was rightly separated from *V. orientale*, and validly published, by BOISSIER.

VAN TIEGHEM's *Viscum Aitchisoni* was published as a *nomen nudum* in 1896, and was based on AITCHISON's *Viscum album*, mentioned in Journ. Linn. Soc., bot., 18, p. 92, and distributed, under the herbarium numbers 48 and 87. Now I met with AITCHISON's Kurram Valley *Viscums* in the Kew and Dehra Dun herbaria. In the Kew herbarium I found *Viscum cruciatum* attached to an olive twig, and on the same sheet *V. album* without host tree, and to these two species two labels, one mentioning *Viscum* no. 48 as a parasite on

olive, and another mentioning *Viscum* no. 87 as a parasite on *Quercus Ilex*; moreover two labels bearing on both the numbers 48 and 87, therefore without value to our purpose. In the Dehra Dun Herbarium I found the same, with exception of the fact that a separate label for no. 87 was absent. These facts give me the certainty, that AITCHISON's *Viscum album* is partly this species, partly *V. cruciatum*, and it is highly probable, that no. 48, indicated as a parasite on olive, is *V. cruciatum*, whereas no. 87, indicated as a parasite on *Quercus*, is *Viscum album*.

Specimens examined:

PALESTINE, without exact locality, PINARD s. n. (DD, K); BOISSIER s.n. (K) ♀; Jerusalem, CHRISTY s. n. (K) ♀; MEYERS 5458 (K) ♂, and B162 (K) ♀; 800 m, DINSMORE 8162 (Gron) ♀, "on olive trees"; temple area, HEYNE s. n. (K) ♂, "on olive trees"; Mount of Olives, BORNMÜLLER 1414 (K) ♀; "in arboribus vetustis horti Gethsemani", SIEBER s. n. (K) ♀, "*Viscum cruciatum* SIEBER" *type* of this and of *Viscum Willdenowianum* MOLKENBOER; Holy Land, Jebel Attarus, Moab, HEYNE s. n. (K) ♀; Syria, HOOKER & HANBURY s. n. (K) ♀; South Syria, Nablous, LOWNE s. n. (K) ♂ & ♀.

INDIA. Afghanistan, Tors-appar, Khyber Pass, 34° N. L., 5200 ft alt., JOHNSTON 73 (K) ♀; Kurrum Valley, Ballish Khel (or Badishkhél), AITCHISON 48 (DD, K) ♀, "common on olive"; N. W. Frontier Prov., Chitral, Pangkora Valley, 4000 ft, GATACRE 17527 (DD) ♀; Samana Range, HARE s. n. (DD) ♀; Hazára, Mushturah, 4500 ft, INAYAT 20934 (DD) ♀; West Himalaya, Tirah, DUTHIE 134 (K) ♀.

6. **Viscum mysorense** GAMBLE, in Kew Bull. 1925 (1925) 329; Fl. Madras, 7 (1925) 1257, 1259. — Vide *tab. II, A*.

All parts with a golden-yellow hue. Only *stem* available slender, over 50 cm long, at nearly all the nodes di- or trichotomous, its basal portion terete, 5—6 cm long, up to 3 mm in diameter, longitudinally wrinkled, hardly striped, slightly thickened at the nodes, the young internodes usually 2.5—4 cm long, distinctly longitudinally striped with shallow grooves, nearly terete or slightly flattened near the base, 1—1.5 mm broad, strongly alternately flattened and double-edged towards the apex, 2—3 mm broad. *Leaves* normally developed only on a part of the nodes, the largest obtusely lanceolate to spathulate, up to 4 cm long by 10 mm broad, often smaller, rounded at the apex, tapering into a short petiole that is rounded beneath, flat or slightly canaliculate above, the lamina rather thick-coriaceous, with 3 longitudinal nerves, that are somewhat more distinct above than beneath and connected by indistinct veins. Leaves scale-like on most of the nodes, nearly 0.5 mm long, acute; also 2 scales (prophylls) at the base of all

ramifications. *Inflorescences* rarely terminal, usually axillary or at both sides of the axillary ones, sessile or shortly pedunculate 1—3-flowered cymes; peduncle flattened, up to 1 mm long and broad, bearing at its apex 2 opposite acute bracts forming together a naviculate cup up to 2 mm long, each bearing one sessile flower in their axil devoid of a bracteal cup and usually male, rarely female, nearly 1 mm long and compressed between the bract and the middle flower; moreover a middle flower, female, rarely sessile and without bracteal up, usually very shortly pedicellate and surrounded by a cup composed of two small bracts alternating with those of the lower pair. *Fruit* unknown. (Description from the type specimen in the Kew Herbarium.)

Remarks. *Viscum mysorense* is a remarkable and very distinct species. According to the structure and distribution of the infloresceences it belongs to the leafless species like *Viscum articulatum*, but it certainly is no leafy form of any of the leafless species dealt with in this paper. As to the flattening of the articulations, it is intermediate between the leafy and the leafless forms, just like *Viscum Wrayi*, but it is entirely different from this species and its allies by the structure of its inflorescences.

SOUTHERN INDIA, Mysore, Arsikere, 2000 ft, MEEBOLD 8207 (BD, K), in the latter herbarium *type* of the species.

7. **Viscum articulatum** BURMANNUS, Fl. ind. (1768) 211; KORTHALS, in Verhand. Batav. Genootsch., 17 (1839) 258; KURZ, in Journ. As. Soc. Beng., 40, II (1871) 64; For. Fl. Burma, 2 (1877) 325; excl. *var. dichotoma*; HOOKER FIL., Fl. Br. Ind., V, 13 (1886) 226, p.p., et excl. *var. dichotoma*; RIDLEY, in Transact. Linn. Soc., ser. 2, 3 (1893) 343; BRANDIS, Ind. trees (1906) 552, 716, p.p.; GAMBLE, in Journ. As. Soc. Bengal, 75, II (1914) 389; *Viscum fragile* WALLICH, ex DE CANDOLLE, Prodr., 4 (1830) 284; G. DON, Gen. Hist. Dichl. Pl., 3 (1834) 407; *Viscum aphyllum* GRIFFITH, Not. pl. as., 4 (1854) 634; Ic. pl. as., 4 (1854) t. 630; *Aspidixia articulata* VAN TIEGHEM, in Bull. Soc. Bot. Fr., 43 (1896) 193; *Viscum flexuosum* GAMBLE, in Kew Bull. 1913 (1913) 47; in Journ. As. Soc. Bengal, 75, II (1914) 389; RIDLEY, Fl. Mal. Pen., 3 (1924) 165; *Viscum angulatum* (non HEYNE) BENTHAM, Fl. austr., 3 (1866) 396; FERNANDEZ-VILLAR, Noviss. app. (1880) 184; F. v. MUELLER, Syst. cens. Austr. pl. (1882) 64; BAILEY, Synops. Queensl. Fl. (1883) 451; F. v. MUELLER, Sec. syst. cens. (1889) 111; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., III, 1 (1889) 195, p.p.; Nachtr. (1897) 140, p.p.; MERRILL, in Philipp. Journ. Sc., bot., 4 (1909)

151; BAILEY, Compreh. Catal. Queensl. Pl. (1913) 460; KOERNICKE, in Annal. Jard. Bot. Buitenzorg, supplem. 3, II (1910) 678 seq.; KOORDERS-SCHUMACHER, Syst. Verz., I, fam. 67 (1912) 4; MERRILL, Spec. Blanco. (1918) 133; in Philipp. Journ. Sc., 15 (1919) 234; DOMIN, Beitr. Fl. Austr., I, 3 (1921) 605; BLAKELY, in Proc. Roy. Soc. Queensl., 34, 1 (1922) 30, 63; MERRILL, Enum. Phil. Fl. Pl., 2 (1923) 113; SP. MOORE, in Journ. Bot. Bot., 63, supplem. (1925) 90; BLAKELY, in Proc. Linn. Soc. N.S. Wales, 53, 2 (1928) 47.

Synonyms and literature that were mentioned by the author in previous publications (mainly Bull. Jard. Bot. Buitenzorg, sér. 3, XI, 3—4; XVI, 1; Philipp. Journ. Sc., 58, 1) and did not need correction or discussion, have not been mentioned again.

While revising the leafless *Visca* of the Asiatic Continent, I soon discovered that the real *Viscum articulatum* reaches its North-western limit south of the Brahmaputra, and does not, or only rarely, occur in China. It has originally been described from Java, and not only occurs in the whole Malay Archipelago between Luzon, Sumatra, and New Guinea, but also in the Malay Peninsula, Indo-China as far north as Tonkin, and North Queensland, and is in many regions a common species. While revising the Indo-Chinese *Loranthaceae* I learned how to distinguish it from *V. liquidambaricolum*, which in these countries occurs along with it. Though the distinction is often difficult, transitional forms are absent. Now most of the leafless *Visca* collected in British India appear to belong to other species, certainly but little different from *V. articulatum* and very difficult to be distinguished, but probably sharply delimited against it.

The real *V. articulatum* has rather narrow, or very narrow, or more rarely rather broad, usually strongly flattened, internodes, and small, globose, usually white or light-yellowish fruits; it is usually parasitic on *Loranthaceae*. The other leafless British-Indian *Visca* are sometimes as narrow as *V. articulatum*, sometimes distinctly broader, and have larger and darker-coloured fruits; these fruits are either globose or more oblong, and their exact colour, rarely indicated on the herbarium labels, seems to be yellow or brownish. They rarely seem to grow on *Loranthaceae*. Cfr. the discussions of *V. nepalense*, *V. liquidambaricolum*, and *V. angulatum*.

Owing to the inadequate descriptions and imperfect herbarium materials, it is extremely difficult, if not entirely impossible, to disentangle wat has been taken together under *V. articulatum* in different floras. What I am giving in the list of synonyms and

literature must be considered as approximative and incomplete.

Of the synonyms, *V. fragile* and *V. flexuosum*, based on British-Indian plants, may be shortly discussed.

V. fragile has been based, by A. P. DE CANDOLLE, upon a plant so named by WALLICH, and collected near Martaban and Tavoy. In these regions *V. articulatum* seems to be common, and the plants seen by me in the Kew Herbarium under number 498 are undoubtedly *V. articulatum*.

GAMBLE did not fail to notice the difference between *V. articulatum* and its nearest allies. In most of his papers he united them under one specific name, but the plant, distinguished by me as *V. nepalense*, was then considered by him as a *var. dichotomum*. In his revision of the *Loranthaceae* of the Malay Peninsula he kept *V. dichotomum* separated from *V. articulatum* as a species, and moreover distinguished a third species, *V. flexuosum*, in the following way (*l. c.*, p. 385):

Articles 4—10 mm. broad; flowers comparatively large, in many fascicles; berry 5 mm. in diam. . . . . . . *V. dichotomum*

Articles 2—4 mm. broad; flowers very minute, in few fascicles; berry about 3 mm. in diam. . . . . *V. articulatum*

Articles 2 mm. broad; flowers very minute, in few fascicles; berry about 2.5 mm. in diam. . . . . *V. flexuosum*

For the distinction of the first two species see the discussion of *V. nepalense*. *V. flexuosum*, though differing more strikingly from both *V. articulatum* and *V. dichotomum* at first sight, must be considered, in my opinion, as a very narrow form of *V. articulatum*. Besides in the vicinity of Singapore, such very narrow forms occur also elsewhere in the area of *V. articulatum*, and it is perhaps more out of reverence for GAMBLE's knowledge and sharp insight, that I accept his *V. flexuosum* as a variety of *V. articulatum*. See also the discussion of the synonym *V. elongatum*, under *V. nepalense*.

Specimens examined:

INDIA. Assam, WALKER s. n. (K); Khasia, GRIFFITH, Kew Distr. 2743 (BD, K); Khasia, Nongbri, 5000 ft, CLARKE 19286 (B, K); prov. Panur, 3—5,000 ft, HOOKER & THOMSON s. n. (K), "parasitic in *Osyris*"; Myrung (?), 3—5,000 ft, HOOKER & THOMSON s. n. (K), "growing on *Loranthus*"; Upper Burma, Ruby Mines, ABDUL HUK 171 (DD); Rangoon, small plant on PARKER's no. 2781, which is *V. monoicum* (K); Rangoon, University Avenue, PARKINSON 14391 (DD), on *Viscum monoicum*; "juxta ripas flum. Martabaniae" and "Tavoy", WALLICH 498 (G, K), "*Viscum fragile* WALL." *type*; Tavoy, Maungmagon, PARKER 2157 (BD, DD), "parasite on *Loranthus*, forming dense tufts 18 inches in diameter"; Penang, 1000—2500 ft,

KING's collector 1186 (K), "flowers pale green, fruit glossy white"; Penang Hill, SCOTT s. n. (K), "parasite on *Loranthus pentandrus*"; Perak, SCORTECHINI s. n. (DD); Perak, Simpang, plains, WRAY 2023 (K), named as *V. dichotomum* by GAMBLE; Kelantan, Kota Bahru, RIDLEY s. n. (K); Trengganu, YAPP 393 (K); Malacca, CUMING 2258 (K); MAINGAY 1406 = Kew Distr. 697 (K); HERVEY s. n. (K), named as *V. dichotomum* by GAMBLE; GRIFFITH Kew Distr. 2742 (K), named as *V. dichotomum* by GAMBLE; Negri Sembilan, Kuala Pilah, Singapore Field No. 9801 coll. HOLTTUM (K); Singapore Gardens, RIDLEY s. n. (BD).

Moreover the following 4 specimens of the **Viscum articulatum** var. **flexuosum** (GAMBLE) DANSER, nov. var. = *Viscum flexuosum* GAMBLE, in Kew Bull. 1913 (1913) 47; Journ. As. Soc. Bengal, 75, II (1914) 389.

Singapore Island, KING's collector 1187 (K), "ripe fruit glossy white"; Singapore, Tanglin, RIDLEY 6018 (K); Singapore, MURTON 151 (K); Fresh Water Island, RIDLEY 100 (BD, K), "parasitic on a species of *Loranthus*".

CHINA. Probably the following: Kwangsi prov., Nan-ning, 140 m, SIN & WHANG 2 (BD), with one small globose fruit, twigs like typical *V. articulatum*, host not mentioned.

COCHIN-CHINA AND SIAM. Cfr. Bull. Jard. Bot. Buitenzorg, sér. 3, XVI, 1, p. 56—57; XVI, 3, p. ?.

PHILIPPINE ISLANDS. Cfr. Philippine Journ. Sc., 58, p. 142.

FURTHER MALAY ARCHIPELAGO. Cfr. Bull. Jard. Bot. Buitenzorg, sér. 3, XI, p. 463—464; Rec. Trav. Bot. Néerl., 31, p. 758; Blumea, III, p. 58.

Moreover:

FLORES, Keo, 1200 m, DE VOOGD 2823 (B). TIMOR, South Central, Soë, 2500 ft, in forest, WALSH 20 (BD).

AUSTRALIA. Cfr. BLAKELY, in Proc. Linn. Soc. N. S. Wales, 53, p. 48, under *Viscum angulatum*.

Specimens examined: Queensland: North Queensland, Mt. Molloy (?), 1200 ft, BRASS 2519 (Bris), "parasitic on *Loranthus sp.* on *Casuarina sp.*"; Mowbray River, BRASS 1933 (Bris, H), on *Loranthus sp.*; Rockhampton, DIETRICH 374 (BD); Brisbane River, DIETRICH s. n. (BD); Goodna, 15 mi. w. of Brisbane, 100 ft, HUBBARD 2899 (H), "on *Loranthus* which was growing on *Eucalyptus tereticornis*, fruits yellow"; Stewart River, JOHNSON s. n. (BD). Moreover: North Expedition, Adelaide, SCHULTZ 475 coll. SCHOMBURGK (BD).

8. **Viscum nepalense** SPRENGEL — *Viscum dichotomum* (non GILIBERT 1792, nec SPRENGEL 1825) D. DON, Prodr. fl. nepal. (1825) 142; A. P. DE CANDOLLE, Prodr., 4 (1830) 284?; G. DON, Gen. Hist. Dichl. Pl., 3 (1934) 407?; ELLIOTT, in Journ. Linn. Soc., 29 (1893) 45; GAMBLE, in Journ. As. Soc. Bengal, 75, II (1914) 388, p.p.; RIDLEY, Fl. Mal. Pen., 3 (1924) 164, p.p.; *Viscum nepalense* SPRENGEL, Syst. veg., cur. post. (1827) 47; *Viscum elongatum* A. P. DE CANDOLLE, Prodr., 4 (1830) 284; G. DON, Gen. Hist. Dichl. Pl., 3 (1834) 407; *Viscum attenuatum* A. P. DE CANDOLLE, Prodr., 4 (1830) 284; WIGHT & ARNOTT, Prodr. Pen. Ind. Or. (1834) 380; G. DON, Gen. Hist. Dichl. Pl., 3 (1834) 407; THWAITES, Enum. pl. Zeylan. (1859) 136; BRANDIS, For.

Fl. N.W. & Centr. Ind. (1874) 394, p.p.; TRIMEN, Syst. Catal. Ceyl. pl. (1885) 77; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., Nachtr. (1897) 140; *Viscum opuntioides* (non LINN. 1753) ROXBURGH, Fl. ind., ed. 2, 3 (1832) 764; ed. 3 (1874) 715; *Viscum articulatum* var. *dichotomum* KURZ, For. Fl. Burma, 2 (1877) 325?; *Viscum articulatum* (non BURMANNUS 1768) HOOKER FIL., Fl. Br. Ind., V, 13 (1886) 226, p.p., incl. var. *dichotoma*; COLLETT & HEMSLEY, in Journ. Linn. Soc., 28, bot., No. 189 –191 (1890) 121; GAMBLE, Man. Ind. Timb. (1902) 584; BRANDIS, Ind. trees (1906) 552, p.p.; COOKE, Fl. Bombay, II, 3 (1906) 553, p.p., incl. var. *dichotoma*; TALBOT, For. Fl. Bombay, 2 (1911) 423, ic. 482; DUTHIE, Fl. Upp. Ganget. Plain, III, 1 (1915) 65; HAINES, Bot. Bihar & Orissa, 5 (1924) 804; PARKER, For. Fl. Punjab (1924) 441, p.p.?; GAMBLE, Fl. Madras, 7 (1925) 1258, 1259, incl. var. *dichotomo*; FISCHER, in Rec. Bot. Surv. India, XI, 1 (1926) 161 seq., cum var. *dichotoma* p. 181; OSMASTON, For. Fl. Kumaon (1927) 465, p.p.; HANDEL-MAZZETTI, Symb. sinicae, VII, 1 (1929) 160, prob.; KANJILAL, For. Fl. Pilibhit &c. (1933) 319; *Aspidixia dichotoma* & *A. attenuata* VAN TIEGHEM, in Bull. Soc. Bot. Fr., 34 (1896) 193.

Stems slender and probably hanging, to 100 cm and more long, strongly branched, the branches generally decussate but often more or less than two at each node; lower internodes terete, usually 2—5 cm long, more or less thickened at the nodes, the younger ones slightly flattened at the base, strongly so towards the apex, usually 2—6 cm long, 3—10 mm broad, with truncate, or in broad forms with somewhat rounded apex. *Leaves* all scale-like, at first erect, spreading later, 0.5—0.75 mm long, obtuse; scales at the bases of the branches indistinct. *Inflorescences* sessile and crowded, up to 2 mm long and finally as broad, usually 1—3-, rarely 5-flowered, first developing one terminal female flower sustended by a pair of bracts connate into a cup, then a pair of lateral male flowers below this cup and in the axils of another pair of bracts, but not sustended each by a pair of bracts of their own, rarely below these another pair of male flowers, likewise in the axils of bracts and without a pair of bracts of its own, decussate with the upper pair; often later (usually after the male flowers have fallen off) at the base of the inflorescence two new ones, which usually remain restricted to one female flower sustended by a bracteal cup; bracts of the flowers all nearly 0.75 mm long, rounded. Young *fruits* globose or somewhat oblong, smooth (wrinkled by drying), older fruits nearly globose, usually 3—4 mm in diameter. (Description mainly from materials in the Kew Herbarium.)

R e m a r k s. *Viscum nepalense*, as it is distinguished here, is most closely related to *V. angulatum*, *V. articulatum* and *V. liquidambaricolum*. It seems to differ from *V. angulatum* by its discussately flattened internodes only. Neither in the inflorescences, flowers, and fruits, nor in the choice of the host plants (cfr. in the first place FISCHER, l. c.) could I discover any differences. Contrary to what I had expected, I found *V. nepalense* and *V. angulatum* sharply delimitated against each other, and I could not discover any intermediate forms. This is the reason why I have kept them apart as species, but it seems quite possible that they should be varieties of one species.

The delimitation of *V. nepalense* against *V. articulatum* gives other difficulties. Though probably here the differences are more important, it is the inadequate state of the herbarium materials that makes a distinction very difficult. In most of the herbarium specimens flowers and fruits are absent, or the fruits are shrivelled in such a way that their size and colour can hardly be estimated. Extensive and exact label notes about the host plant and the form, size, and colour of the fruits are indispensable for a more thorough study of the species limits in this critical group. Better still it would be to study the living plants in those regions where *V. nepalense* and *V. articulatum* occur together (Assam to Perak, and perhaps more to the South), and by botanists who live there and are in a position to compare the two species at leisure. As GAMBLE distinguished them mainly by means of the width of the internodes (cfr. what has been cited in the discussion of *V. articulatum*), it is no wonder that he includes specimens in *V. nepalense*, which I prefer to include in *V. articulatum*, and that he mentions much more southern localities for *V. nepalense* than I do.

We meet with more serious difficulties when trying to distinguish *V. nepalense* from *V. liquidambaricolum*. There seems to be only one real difference, *viz.*, the ripe fruits being nearly globose in *V. nepalense*, more oblong in *V. liquidambaricolum*. To this may be added that *V. nepalense* usually has broader internodes than *V. liquidambaricolum*, but this difference is not to be depended on. It remains, therefore, very doubtful, whether *V. nepalense* and *V. liquidambaricolum* are distinct species or geographical varieties of one species. I am much inclined to accept the latter supposition, because it is remarkable that, if we take the form of the fruits as a criterion, *V. nepalense* in its further characters shows a distinct approach towards

V. liquidambaricolum when we come nearer to the area of distribution of the latter.

In India *V. nepalense* is rather uniformous, and not restricted to special hosts (see FISCHER, l. c.). In the Himalaya we meet with forms with narrower internodes, and others with somewhat oblong fruits, which may be regarded as transitions towards *V. liquidambaricolum*. At the same time it is more restricted to *Quercus* and *Liquidambar*, the typical hosts of *V. liquidambaricolum*. More to the East, in China, *V. nepalense* is hardly found any more, and *V. liquidambaricolum* continues getting still narrower. All this gives the impression, that the Indian *V. nepalense*, with broad and coarse internodes and globose fruits, gradually merges into the East-Asiatic *V. liquidambaricolum*, with narrower and slenderer internodes and more oblong fruits. On the other hand, typical *V. nepalense* and typical *V. liquidambaricolum* seem to occur together in certain regions, especially in certain parts of the Himalaya, and as long as their specific rank is still doubtful, I prefer to draw attention to this question by accepting them as separate species.

In China we find, apart from the specimens with narrow internodes and oblong fruits (real *V. liquidambaricolum*), also such with narrow, but very thick, almost terete internodes. Whether the latter only represent a form of *V. liquidambaricolum* or a separate (new) species, I was unable to settle, and therefore I have previously included them in *V. liquidambaricolum*.

In the southern part of the Deccan Peninsula, there occur leafless *Visca* of this alliance with very narrow internodes, which strongly call to mind *V. articulatum* (WIGHT 1228, WIGHT Kew distr. 1248, WALLICH 496, BOURNE 864), but I found no data that prove the occurrence of *V. articulatum* in these regions. The same may be said of a few specimens from Ceylon examined by me.

In my revision of the *Loranthaceae* of the Netherlands Indies I did not distinguish *V. nepalense* from *V. articulatum*. Yet the former seems to occur in the Malay Peninsula south of Siam. The specimens from Perak, mentioned below, are not beyond doubt, but very probable. Among the leafless *Visca* of French Indo-China, Siam and the Philippine Islands, I found no specimens possibly belonging to *V. nepalense*.

A remarkable form is the new variety *thelocarpum*. It has entirely the appearance of *V. nepalense*, and belongs to the narrow forms of this, but the young fruits are warty. As a rule, warty fruits indicate

separate species, but I had not sufficient reasons to give the new form more than varietal rank. Other leafless *Visca* with warty fruits are found in Africa, but these are dioecious.

As regards the nomenclature of this species it must be remarked, that none of the names enumerated among the synonyms is quite certain.

With his *V. dichotomum* D. DON certainly meant forms of this alliance, but from his short description it is not clear whether he distinguished between the forms with broader internodes and globose fruits and those with narrower internodes and more oblong fruits. His description runs as follows:

"*V. dichotomum*, aphyllum; ramulis compressis striatis articulatis: articulis subtrifloris, internodiis ovali-oblongis. Hab. in Nepaliâ ad Narainhetty. Hamilton. Wallich."

I have not seen HAMILTON's plant, nor do I know where it is preserved now. WALLICH's plant has been indicated without number, and hence I do not know what plant it is. In Nepal undoubtedly our *V. nepalense* occurs as well as *V. liquidambaricolum*, and from the description one would suppose that DON had meant a form with broad articulations, *i. e.*, our *V. nepalense*.

DE CANDOLLE only mentions WALLICH's plants, and in his herbarium in Geneva these are actually present. According to notes made by me from these specimens, WALLICH's plants are different among each other, but all are coarse and broad, and therefore probably *V. nepalense*. DE CANDOLLE, however, adds to his description: "Bractea membranacea cupularis sub fructu ovali", which calls to mind *V. liquidambaricolum*. I suppose that DE CANDOLLE mainly based his description on specimens of *V. nepalense*, but I think it not at all impossible that among his specimens there were of *V. liquidambaricolum*.

The name *V. dichotomum* cannot, however, be valid, as before DON's *V. dichotomum* there had already been published two other plants as *V. dichotomum*, *viz.*, *V. dichotomum* GILIBERT in 1792, which represents *V. album*, and *V. dichotomum* SPRENGEL in 1825, an American species, later transferred to *Phoradendron*. In 1827, SPRENGEL therefore replaced DON's name by that of *V. nepalense*, which name, though somewhat doubtful, is the best name for our species.

Also DE CANDOLLE's names *Viscum elongatum* and *V. attenuatum* are not quite certain. The specimens of *V. elongatum* in DE CANDOLLE's herbarium are strongly flattened forms without fruits, and probably

represent *V. nepalense*, but they might be *V. liquidambaricolum*, as in Assam, whence *V. elongatum* is mentioned, also *V. liquidambaricolum* certainly occurs. WALLICH's specimens in the Kew Herbarium have somewhat oblong fruits, but yet seem to be *V. nepalense*. DE CANDOLLE's *V. attenuatum* is based on the *V. opuntioides* of HEYNE's herbarium; HEYNE's specimens in DE CANDOLLE's herbarium rather seem to be *V. articulatum*, but might be a narrow form of *V. nepalense*; those in the Kew Herbarium partly look like *V. articulatum*, but partly undoubtedly are *V. nepalense*. From this it is evident that neither the name *V. elongatum* nor that of *V. attenuatum* must be preferred to that of *V. nepalense*.

Specimens examined:

INDIA. Without exact locality: ROXBURGH s. n. (K), originals of *Viscum opuntioides* ROXBURGH; HEYNE s. n. (BD), ex Herb. ROTH, "*V. opuntioides*"; WALLICH 496 (K), "*Viscum opuntioides* LINN. ? Herb. Heyneanum"; WIGHT 1228 (BD, G, K), "*Viscum attenuatum* D. C.", *types*; WIGHT Herb. 48 (BD, DD); Peninsula Indiae Orientalis, Paulghautcherry, WIGHT Herb. 48 = Kew Distr. 1248 (K), no ripe fruit, narrow articulations, looks like *V. articulatum*; "Nundydr.", HEYNE s. n. (K), "*V. opuntioides*" Hb. ROTTLER ex Hb. HEYNE; Ceylon, THWAITES C. P. 1637 (K); Galagama, THWAITES C. P. 479 (K); Komagalli (?), THWAITES C. P. 479 (BD); Murroothey Malay nr. Coimbatore, WIGHT Kew Distr. 1248 (K); Cooridy Malay nr. Coimbatore, WIGHT 48 (K); Coimbatore Distr., Sivahamudram, BARBER (?) 10376 (K); Vizagapatam Distr., Karaka, BARBER 1607 (K); Palni Hills, SAULIÈRE 635 (K); Kodaikanal Ghat, BOURNE 864 (K); "Mont. Nilghiri & Kurg", THOMSON s. n. (BD, K); Nilgiris, Segor Ghat, LAWSON s. n. (K); Culhatty, 4000 ft, CLARKE 11266 (B, K); Masnagoodi, DAS 138 (DD); Coonoorshal, 1850 ft, FISCHER 2079 (DD); Madras, Kistna, HEARSEY s. n. (DD); Bangalore, Ayyur, BOR 7512 (DD); Mysore, Circars, WIGHT s. n. (K); Bhimanbidu, BARBER 6821 (K); Seegor, 3000 ft, CLARKE 11254 (K); Kumsi, 2—3,000 ft, MEEBOLD 10152 (BD); North Kanara, Ghauts, RITCHIE 333 (K); Devikope, TALBOT 16 (K), 1142 (DD); Central Prov., Chánda Distr., DUTHIE 9727 (DD), "on *Diospyros*"; Pachmarhi, DUTHIE 10549 (DD); Orissa, Puri Distr., Partab, LACE 2510 (DD); Sambalpur, GRIFFITH s. n. (K); Bihar, 1000 ft, HOOKER s. n. (BD, K); Bihar, Banda, EDGEWORTH 4004 (K); Monghyr, LOCKWOOD s. n. (K); Chota Nagpur, Kumandi Reserve, Palamow, GAMBLE 8810 (K); Kodenua, Hazaribagh, GAMBLE 10232 (DD, K), "on *Diospyros*"; Hazaribaugh, VICARY s. n. (K); Chakulia, Dhalbhúm, GAMBLE 9210 (K), "on Ebony"; Sillee, Rahé outpost, 500—1000 ft, WOOD s. n. (K); N. W. Himalaya, Bhimtal, 4500 ft, MEEBOLD s. n. (BD); Simla, Hundwan, GAMBLE (?) 1143 (DD); Jubbal State, Piuntra, 4000 ft, KANJILAL 1100 (DD); Saharanpur Siwaliks, GAMBLE 25663 (DD, K); Ranipur Siwaliks, 1000 ft, KANJILAL 1099 (DD), on *Cordia*; 1200 ft, KANJILAL 1038 (K); Garhwal, Naini Tal, Dogori, Haldwani, MANOHARLALL s. n. (DD); Haldwani, 1000 ft, OSMATON 1310 (DD), on *Cassia fistula*; Dhela, KANJILAL 1299 (DD); Chuia Range, Laria Kanta, 7700 ft, URTI DUTT 8101 (DD); Almora Distr., Siuni, 1800 m, PARKER 2022 (DD), on *Quercus incana*, one specimen bearing a young plant of *Taxillus vestitus*; Bijnor Dist., Barhapura, MARKHAM s. n. (DD), on *Diospyros melanoxylon*; Upper Gangetic Plain near Nipal frontier,

Khairbatti, INAYAT 23818 (BD, DD); Nipal, HORNEMANN s. n. (BD); Sikkim, THOMSON s. n. (DD); 7—8,000 ft, ROGERS s. n. (DD), *on Quercus*; lower hills to 4000 ft, HOOKER s. n. (K); Preng Kola, Munsong, CRAIB 341 (B, K); Namchee, 7000 ft, CLARKE 27572 (K); Darjeeling, 7000 ft, GAMBLE 370 (DD, K) on *Acer*; GAMBLE 698 (DD, K), on *Acer, Castanea*; GAMBLE 2979 (K); E. Bengal, Mishmee, GRIFFITH Kew Distrib. 2744 (BD, DD, K); E. Himalaya, Tsangpo Gorge, 5—6,000 ft, F. KINGDON WARD 6359 (K), particularly on *Dalbergia*; Chibaon, Delei Valley, 28°10′ N., 96°30′ E., 8000 ft, F. KINGDON WARD 8059 (K); Assam, Sylhet, Pundua, WALLICH 495 (G, K), "*Viscum elongatum*", *types*; Khasia, OLDHAM s. n. (DD); SIMONS s. n. (B, BD); Khasia Hills, HOOKER s. n. (DD); native collector Bot. Gard. Calcutta s. n. (B, DD); Surureen, GRIFFITH s. n. (K); HOOKER FIL. & THOMSON 1226 (K); Naga Hills, Pulebadze Ridge, 7000—7500 ft, BOR 2992, 2993 (DD, K), on *Quercus semiserrata*; Konoma, Reporter Econ. Prod. Government India 11750 (B); near Phesama, PRAIN s. n. (B); Lushai Hills, Phongpui, 6000 ft, PARRY 555 (K); Shan Hills, Lwe Kaw, 5000 ft, COLLETT 718 (K).

MALAY PENINSULA. Perak, Larut, within 300 ft, KING's coll. 4191 (BD, DD, K), a parasite 1 to 2 feet long, colour light green when young, dark green when old.

CHINA. Yunnan, DUCLOUX 606 (K); Mengtsz, HANCOCK 362 (K). These two Chinese specimens have no fruit, and are therefore doubtful.

Viscum nepalense var. **thelocarpum** DANSER, nov. var. — Omnino ut *Viscum nepalense*, sed fructibus immaturis diverso modo verruculosis, maturis minus verruculosis.

INDIA. Concan, reg. trop., STOCKS s. n. (BD, K), *type* of the variety; Concan, Bombay, LAW s. n. (K); Ajmere, coll.? (DD); Canara, Ooshelé, RITCHIE 333 (K), "on seeshum tree".

9. **Viscum liquidambaricolum** HAYATA — *Viscum angulatum* (non HEYNE) KORTHALS, in Verhand. Batav. Genootsch., 17 (1839) 258; MOLKENBOER, in MIQUEL, Pl. Junghuhn., 107 (1852); MIQUEL, Fl. Ind. Bat., I, 1, 5 (1856) 806; *Viscum articulatum* (non BURMANNUS) FORBES & HEMSLEY, in Journ. Linn. Soc., bot., 26, No. 177 (1894) 407; COLLETT, Fl. siml. (1902) 440, ic. 143; BRANDIS, Ind. trees (1906) 552, p.p.; MATSUMURA & HAYATA, Enum. pl. Formos. (1906) 357; LÉVEILLÉ, Catal. pl. Yun-nan (1916) 172; LECOMTE, in SARGENT, Pl. Wilson., III, 2 (1916) 318; GROFF, DING, & GROFF, in Lingn. Agric. Rev., I, 2 (1924) 76; PARKER, For. Fl. Punjab (1924) 441, p.p.?; OSMASTON, For. Fl. Kumaon (1927) 465, p.p.; DANSER, in Blumea, II, 2 (1936) 55; *Viscum articulatum* var. *Balansae* LECOMTE, Fl. Indo-Ch., V, 3 (1915) 210; Not. syst., 3, 173 (1915); *Viscum liquidambaricolum* HAYATA, Ic. pl. Formos., 5 (1915) 194, ic. 71 & 72; DANSER, in Trop. Nat., 18 (1929) 119; in Bull. Jard. Bot. Buitenzorg, sér. 3, XVI, 1 (1938) 57; *Viscum bongariense* HAYATA, Ic. pl. Formos., 5 (1915) 190, ic. 65 & 66; *Viscum Querci-Morii* HAYATA, ibid., p. 196, ic. 74; *Viscum stenocarpum* DANSER, in Bull. Jard. Bot. Buitenz., sér. 3, XI, 3—4 (1931) 469.

When revising the *Loranthaceae* of French Indo-China and Siam, I learned how to distinguish *V. liquidambaricolum* from *V. articulatum*. These species were sharply delimited against each other there. I could not, however, distinguish *V. liquidambaricolum* from a number of closely allied species also described from Formosa, and I therefore mentioned the latter among the synonyms.

The delimitation against *V. nepalense*, however, is extremely difficult, if not impossible. *V. nepalense* has globose fruits, *V. liquidambaricolum* oblong ones, but most of the herbarium specimens have no fruits at all, or only half-developed or shrivelled ones, and are therefore indeterminable. *V. nepalense* usually has, it is true, broader and more strongly ribbed articulations than *V. liquidambaricolum*, but this character certainly is not to be depended on. As about *V. nepalense* in China I have no other indications but a few fruitless specimens collected in Yunnan, and of *V. articulatum* nothing but one collection from Kwangsi, I include all further Chinese leafless *Visca* in *V. liquidambaricolum*, though I am well aware that among them there may perhaps be closely allied new species. If my delimitation of this species should be correct, *V. liquidambaricolum* would appear to be a much more northern species than *V. articulatum*. Perhaps it is only the eastern variety of the more western *V. nepalense*. See for this the discussion of the latter.

Specimens examined:

INDIA. "*Viscum*, a museo Lambertiano DON misit 1822 (ex Herb. KUNTH)" (BD), perhaps type specimen of *Viscum dichotomum* DON ? — N. W. India, Hb. ROYLE s. n. (K); Kulu Hill States, Bahu, 4500 ft, PARKER s. n. (DD), "on *Cornus capitata*"; Simla, MEEBOLD 5096 (BD); Simla, The Glen, COLLETT s. n. (K); The Glen, 6000 ft, GAMBLE 6233 (DD, K), "on *Cornus capitata*"; Kumaon, Moud li Kaladoonjee (?), DAVIDSON s. n. (DD); Gungoli, 5500 ft, STRACHEY & WINTERBOTTOM 1 (K); Sarju Valley, 3—4,000 ft, DUTHIE 5944 (DD, K), "on *Terminalia Chebula*"; Bhabur of Garhwal, 1000 ft, MADDEN (?) s. n. (K); Naini Tal Div., Muktesar, 6000 ft, OSMASTON 1309 (DD), "on *Loranthus vestitus*"; Bootan, GRIFFITH 2079 (K); Nepal, WALLICH s. n. (K); Sikkim, 4000 ft, KING s. n. (DD); Sikkim, Choongtam Hill, 5—6,000 ft, HOOKER s. n. (K); Assam, Khasy & Jyntea Hills, Lao-soh to Mynkhar, KANJILAL 5935 (DD), "on *Castanopsis hystrix*"; Mao (E. frontier of India), 6500 ft, WATT 6164 (BD).

CHINA. Yun-nan, Lichiang Range, Lat. 27°40′ N., 11,000 ft, FORREST 10174 (BD, E, K), "on pines"; on the Tong Shan in the Yangtze bend, Lat. 27°20′ N., 9—10,000 ft alt., FORREST 11112 (BD, E. K), "on pines and oaks"; *ibidem*, 9,000 ft, FORREST 12719 (E. K), "on pines and poplars"; between Tan-tui and Pungtzula, Lat. 28° N., 10,000 ft, FORREST 13811 (E. K), "stems orange-yellow, on oaks"; on the descent from Lu-tien to the Yangtze, Lat. 27°12′ N., 8,000 ft, FORREST 16142 (E, K), "on *Alnus*, fruits greeny-white"; Shweli-Salwin divide, Lat. 25°40′ N.,

10,000 ft, FORREST 18155 (E, K), "fruit immature greenish-white, on pines and various other trees"; Yun-nan, Mi-lê distr., A. HENRY 9942 (K), "on *Zanthoxylum*"; *ibidem*, 4000 ft, A. HENRY 10303 (BD, K), "on *Castanea*"; Szemao, N. W. Mts., 5000 ft, A. HENRY 10303A (K); Yunnan-fu, DUCLOUX 364 (K); Yunnan-sen, MAIRE 1728 (K); Houang-ts'ao-pa, CAVALERIE 4258 (K); Yungpeh, "in decliv. mont. versus boream", 2600 m, SCHNEIDER 1694 (BD, K); Yangtze Valley, E. H. WILSON 4482 (K); "on *Aleurites Fordii*"; E. Sze-chuan, Tchen-kéou-tin distr., FARGES s. n. (B); Sze-chuan, Nan chuan, v. ROSTHORN 1212 (BD), on *Taxillus*; Hunan prov., Yünshan, Wukang, SIN no. S. H. 854 (BD), on *Fagacea*; Choa-shan, Siangtan, 300 ft, SIN no. S. H. 223 (BD); South Hunan, SIN 338 (BD); Lung Yen Tung nr. Canton, CHUN 7871 (B, S); Kwantung, Yun Fou, C. T. WANG 541 (BD, K); Win Foo, 120 m, SIN 5360 (BD); Swatow, DALZIEL s. n. (K); Amoy ?, HANCE 1451 (K); Amoy interior, SWINHOE s. n. (K); Fukien, Foochow Kushan, CHUNG 3799 (K); Foochow, little wood, CARLES 855 (K); Chekiang, Tai suan, 500—900 m, CHING 2182 (BD, K); Hainan, Nodoa, 250 m, Canton Christian College 7970 coll. MCCLURE (K); Hainan, TSANG FUNG TANG 17593 (H).

Specimens from China, doubtful for lack of fruits: Yunnan, CAVALERIE 3134 (K); Yunnan-sen, CAVALERIE 7323 (K); Huang-ts'ao-pa, CAVALERIE 7496 (K); Sung Kwei Valley, 7000 ft, FORREST 542 (E, K); N. of Yunnan-fu, between Ssiao-ma-kai and Schin lung, near De-ka, SCHNEIDER 263 (BD, K), "on *Fraxinus*"; E. Sze-chuan, Tchen-kéou-tin distr., FARGES s. n. (B, K), named by LECOMTE as "*V. articulatum* var. *nodosum* (v. T.) H. LEC."; Hu-peh, Ichang, Nanto Mts. to northward, A. HENRY 3206 (BD, K), "on t'an tree"; W. Hupeh, WILSON 3262, 3263 (K); Kiang-si prov., Yü Du Hsien, 2000 ft, HU 1172 (BD), "on *Liquidambar*"; Chung Yih Hsien, 2000 ft, HU 916 (BD), on oak, yellow berry; Kwantung prov., Wu-king-fu, a valley of unimportant elevation about 60 miles inland from Swatow, DALZIEL s. n. (K); Fukien, Diongloh, and vicinity, METCALF 2727a (B); Chekiang, Ping-Yang-Hsien, HU 146 (K); Nan-Hoo, S. Yentang, HU 146 (BD), "on oak"; Nan-kong, HU 243 (BD), "on oaks"; Taishun Hsien, KENG 274 (BD), "on *Quercus*"; Hainan, TSANG WAI-TAK 18319 (DD); Hainan, B. C. HENRY 18 (K), "chiefly found on *Liquidambar*"; Nodoa and vicinity, Nai No Mts., TSANG WAI-TAK 91 = Lingnan University 15590 (BD, K).

INDO-CHINA. Cfr. Bull. Jard. Bot. Buitenzorg, sér. 3, VI, 57—58.

FORMOSA. Bankinsing, A. HENRY 59 (K); Nanto prov., nr. Shushu, 2000 m, WILSON 10024 (K); Musha, WILSON 10032 (K); Kagi prov., Arisan, 2133 m, WILSON 9834 (K).

JAVA. Cfr. Bull. Jard. Bot. Buitenzorg, sér. 3, XI, 470.

Viscum diospyrosicolum HAYATA, Ic. pl. Formos., 5 (1915) 192, ic. 67, 68; 6 (1916) 41, ic. 4.

This leafless *Viscum* from Formosa has been described by HAYATA together with other leafless *Visca* from the same Island, *viz.*, *V. bongariense*, *V. filipendulum*, *V. liquidambaricolum*, and *V. Querci-Morii*. Whereas I cannot acknowledge *V. liquidambaricolum*, *V. bongariense*, and *V. Querci-Morii*, as specifically different, I am in doubt about the other two. Though *V. diospyrosicolum* is, according to HAYATA, the most slender among the Formosan *Visca*, the young internodes are

distinctly flattened. The type materials were incomplete, but soon afterwards HAYATA gave a completion to the description on the ground of additional collections, and in this he described the plant as leafy in the basal portion, "foliis oppositis oblongo-ovatis 1½ cm. longis 4½ mm. latis apice obtusissimis basi cuneatis margine integris chartaceis glabris venis haud visis sessilibus". The fruits are described as ellipsoidal, 4.5 mm long by 2 mm in diameter, and this again calls to mind *V. liquidambaricolum*. The presence of leaves in the basal portion does not make this impossible, because *V. ramosissimum*, which perhaps only is a variety of *V. angulatum*, has similar leaves in its basal portion.

Viscum filipendulum HAYATA, Ic. pl. Formos., 5 (1915) 193, ic. 69, 70.

This *Viscum*, published together with the preceding one (cfr. this), is certainly closely allied to it. The stems are very slender, yet with distinctly flattened internodes; the fruits are nearly globose, 7 mm long by 6 mm in diameter. None of these peculiarities, however, makes it impossible that *V. filipendulum* should be a form of *V. liquidambaricolum*, or, together with this, of *V. nepalense*.

10. Viscum angulatum HEYNE, ex A. P. DE CANDOLLE, Prodr., 4 (1830) 283; WIGHT & ARNOTT, Prodr. Fl. Pen. Ind. Or. (1834) 380; G. DON, Gen. Hist. Dichl. Pl., 3 (1834) 407; DALZELL & GIBSON, Bombay Fl. (1861) 110; HOOKER FIL., Fl. Br. Ind., V, 13 (1886) 225; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., III, 1 (1889) 195, p.p.; Nachtr. (1897) 140, p.p.; BOERLAGE, Handl. Fl. Ned. Ind., III, 1 (1900) 167, 172; GAMBLE, Ind. timb. (1902) 584; BRANDIS, Ind. trees (1906) 552; COOKE, Fl. Bombay, II, 3 (1906) 553; TALBOT, For. Fl. Bombay, 2 (1911) 422, ic. 481; GAMBLE, Fl. Madras, 7 (1925) 1257, 1259; FISCHER, in Rec. Bot. Surv. Ind., XI, 1 (1926) 181, seq.; ENGLER & KRAUSE, in ENGL., Nat. Pflanzenfam., ed. 2, 16b (1935) 203; *Viscum ramosissimum* WIGHT, Ic. pl., III, 3 (1845) tab. 1017 tantum.

Stems slender and probably hanging, strongly branched, with decussate branches or more than two branches at each node, all attenuate towards the extremities; lower internodes terete or with two opposite ribs, usually 2—5 cm long, to 4 mm in diameter, usually less thick; articulations of the medium part of the plant usually distinctly 4-angular, sometimes with less prominent ribs between the 4 main ones, hardly attenuate or flattened towards their apices, usually 1—2 mm in

diameter, 1—4 cm long; youngest articulations less thick, terete towards the base, distinctly decussately flattened towards their apices. *Leaves* all scale-like, usually 0.5 mm long or still shorter, short-triangular, obtuse or subacute; also small scales (prophylls) at the bases of all ramifications. *Inflorescences* nearly always sessile, rarely terminal on short twigs and in that case peduncled, 1—3-flowered, if one-flowered with one female flower sustended by two bracts connate at their base, if 3-flowered then moreover with 2 lateral male flowers, these rarely in the axils of the two bracts sustending the female flower, usually below these in the axils of another pair alternating with the upper one; sometimes two more inflorescences, one at each side of the first one and probably in the axils of the indistinct prophylls, these two inflorescences usually one-flowered, more rarely again 3-flowered; still more rarely numerous branchings, the structure of which is not clear, but always all flowers crowded, the whole complex 2—2.5 mm long and broad, the bracts obtuse or rounded. *Fruits* nearly globose in the adult stage, in the herbarium up to 3 mm in diameter, usually surrounded at the base by two depressed bracteal cups. (Description from specimens in the Kew Herbarium.)

Remarks. As already has been remarked in the discussion of *V. nepalense*, *V. angulatum* is a remarkable and sharply delimited form, distinguished from *V. nepalense*, however, by the hardly flattened 4-angular articulations only. It is restricted to the Deccan Peninsula and by no means identical with non-flattened forms of *V. articulatum* from other regions, recorded under this name from the Philippine Islands, the Netherlands East Indies, and Queensland, but differing from *V. angulatum* as distinctly as *V. articulatum* from *V. nepalense*.

Specimens examined:

INDIA. Deccan Peninsula. Without exact locality: "Voyage de N. JACQUEMONT No. 634", or JACQUEMONT 1283 (K); WALLICH Catal. 497 (K) = *Viscum angulatum* Herb. HEYNE; Malabar, Chedleth, 3000 ft, FISCHER 324 (K); Agalhatti, MEEBOLD 8251 (BD); Lonaula (S. India), 2000 ft, MEEBOLD 4250 (BD), "hängt 30—40 cm von den Aesten herab"; Coonoor, BOURNE s. n. (K); Periya Shola Pulneys, BOURNE 191 (K); ... achur Shola, Lower Pulneys, BOURNE 2423 (K); Madura Distr., Lower Pulneys, 4200 ft, SAULIÈRE 262 (K); Madura Distr., Sirumalais (?), BOURNE 1768 (K); Anamallay Forests, WIGHT 52 = Kew Distr. 1246 (BD, K); Mettupalayam, BARBER 8548 (K), on *Zyziphus xylopyrus*; Tambracheri ghaut, BARBER (?) 7400 (K); Coimbatore Distr., Hassanur, BARBER (?) 10531 (K); "Mont. Nilghiri & Kurg, reg. trop.", THOMSON s. n. (BD, K); Coorg, "*Viscum angulatum* HEYNE ex Herb. ROTTLER", *type* ? (K); Nilgiris, S. E. Wynaad, Devala, 3000 ft, GAMBLE 15436 (K); Nilgiri Distr., Kundalu, nr. Kilkunda, 4000 ft, GAMBLE 17242 (K); Nilgiris, Seegor, 3000 ft, CLARKE 11254 (B, K); Nilgiris Distr., Sigúr Ghát, 4000 ft alt., GAMBLE 14508 (DD); Nilagiri, nr. Juduru, HOHENACKER 1478 (BD, K); Mysore,

Singadhully, 3000 ft, TALBOT s. n. (DD); Belgaum, RITCHIE 334 (K); Concan &c., STOCKS s. n. (K); Concan, LAW s. n. (K); Bombay, ex Herb. College of Science, Poona (DD).

11. **Viscum ramosissimum** WIGHT & ARNOTT, Prodr. Fl. Pen. Ind. Or. (1834) 380; WALPERS, Repert., 2 (1843) 437; WIGHT, Ic. pl., III, 3 (1845) p. 13, excl. t. 1017; HOOKER FIL., Fl. Br. Ind., V, 13 (1886) 225; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., III, 1 (1889) 195; TRIMEN, Handb. Fl. Ceylon, 3 (1895) 472; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., Nachtr. (1897) 140; GAMBLE, Man. Ind. timb. (1902) 584; BRANDIS, Ind. trees (1906) 552; COOKE, Fl. Bombay, II, 3 (1906) 554; GAMBLE, Fl. Madras, 7 (1925) 1257, 1258; FISCHER, in Rec. Bot. Surv. Ind., XI, 1 (1926) 161, seq.; ENGLER & KRAUSE, in ENGL., Nat. Pflanzenfam., ed. 2, 16b (1936) 201; *Aspidixia ramosissima* VAN TIEGHEM, in Bull. Soc. Bot. Fr., 43 (1896) 193.

When we delimitate *Viscum ramosissimum* against *V. angulatum* as has been done here, the two species do not show any other difference but the form of the articulations, which in *V. angulatum* are 4-angular, in *V. ramosissimum* terete, with the exception of the very young ones, which in both species are flattened. WIGHT and ARNOTT, the authors of the latter, do not indicate other differences either, and in WIGHT's Icones *V. angulatum* is figured under the name of *V. ramosissimum*. Though it is mentioned, that *V. ramosissimum* sometimes has a few leaves, the herbarium specimens examined are nearly all entirely leafless. Only the specimen WIGHT Cat. 6876 in the Kew Herbarium bears one leaf and, opposite to this, a leaf scar; the leaf is lanceolate-obovate, attenuate towards the base, but not petiolate, rounded at the apex, 22 mm long, 5.5 mm broad, thickish, with 3 hardly prominent, but distinct longitudinal nerves. The originals of *V. ramosissimum* represent an extreme form; they are small specimens, with very densely and finely branched stems, but they are apparently young and bear no flowers nor fruits.

Though *V. angulatum* has been described as early as 1830, and *V. ramosissimum* in 1834, both species are inadequately known and a thorough examination of the living plants is still a desideratum.

Specimens examined:

INDIA. Ceylon, Maturata, coll. ? (K), on *Rhododendron arboreum*; Peninsular India, WIGHT Herb. 53 (BD); WIGHT Catal. 1225 = WALLICH Cat. 6876 (BD, K), *types*; Mt. Gingu, WALLICH Cat. 6876 (K), "*Viscum ramosissimum* WIGHT, *types*; Neelgherry Hills, Iyamalay nr. Coimbatore, WIGHT 53 = Kew Distr. 1244 (K); Coimbatore Distr., Mettupalayam, BARBER 8547 (K); Tinnevelly, Mundanthorai

Ghaut, BARBER 2785 (K); Nilgiris, Blackbridge, 6000 ft, GAMBLE 12115 (K); Coonoor, 6000 ft, GAMBLE 11693 (BD, K).

12. Viscum Loranthi ELMER, Leaflets Philipp. Bot., 8, art. 121 (1919) 3089; MERRILL, Enum. Phil. Fl. Pl., 2 (1923) 113; DANSER, in Bull. Jard. Bot. Buitenzorg, sér. 3, XI, 3—4 (1931) 464, ic. 27, b—c; in Philipp. Journ. Sc., 58, 1 (1935) 142; *Viscum* sp., OSMASTON, For. Fl. Kumaon (1927) 465; *Viscum Osmastonii* RAIZADA, in Indian Forester, 60 (1934) 537, t. 55; *Phacellaria ferruginea* (non W. W. SMITH) HANDEL-MAZZETTI, Symb. sin., VII, 1 (1929) 157.

The discovery of *V. Loranthi* in the Himalaya and Yunnan makes a larger distribution in the mountains of south-eastern Asia probable. Of the Yunnan plant I only examined a few fragments, of the Himalaya plants copious materials, including the types of *V. Osmastonii.* They show hardly any peculiarities when compared with the Luzon and Sumatra plants; the largest specimens are somewhat more robust, with stems up to 5 mm in diameter at the base, up to 18 cm long, and with the thickest whorls of flowers up to 14 mm in diameter. It seems better not to call the fruits verruculose, as it is the swollen epidermis cells that cause the papillose, somewhat glittering surface. The same papillae make the bracts sometimes shortly ciliate. In older fruits the papillae are larger, but they cannot be compared with those of *V. heyneanum* or *V. ovalifolium,* which are much larger and many-celled.

Whereas the Luzon specimens were found parasitic on *Taxillus chinensis* (= *estipitatus*) and the Sumatra ones on *Scurrula ferruginea*, those from Yunnan were parasitic on *Taxillus Kaempferi*, those from the Himalaya on *Taxillus vestitus, Scurrula cordifolia, Scurrula pulverulenta*, and *Dendrophthoë falcata*, all belonging to closely allied genera.

If my former observations on the structure of the inflorescences are correct, I yet would have to add data on the arrangement of the bracts, the high morphological value of which was unknown to me formerly. The examination of these, however, appeared to be very difficult on herbarium specimens. The development of the inflorescences apparently proceeds so quickly, that numerous buds and bracts have already developed before the differences between male and female flowers can be stated, and the bracts are moreover densely crowded and their morphological arrangement seems to be disturbed by reciprocal pressure. I got the impression, that the first axillary flower is sustended by a bracteal cup, and that the next pair of

flowers is placed laterally, sometimes in the axils of the first pair of bracts, sometimes outside the bracteal cup, and that there soon develop more numerous triads of flowers, perhaps at first in the axils of the first one.

INDIA. Dehra Dun, 7 VII 1899, P. W. MUCKUNIM (?) 23028 (K), "on *Loranthus longiflorus*"; Garhwal Div., Mohan Chilkuja Range, 25 V 1902, INAYAT 26008 (K), on *Scurrula cordifolia*; Garhwal, between Mussoorie and Rajpore, 4000 ft, 17 III 1904, DRUMMOND 15081 coll. GOLLAN (K), on *Scurrula* prob. *pulverulenta*; Naini Tal Distr., Bhine Tal, 4000 ft, 28 X 1925, OSMASTON 1291 (K); Gaula Valley, 4200 ft, 24 V 1926, OSMASTON 1308 (K); Kumaon, East Almora Div., Nalia Reserve, 6000 ft, 8 I 1933, OSMASTON 1536 (DD, K), "parasitic on *Loranthus vestitus*, which was parasitic on *Quercus dilatata*", *type* of *Viscum Osmastonii* RAIZADA. Probably also: Kumaon, STRACHEY & WINTERBOTTOM 4 (K).

CHINA. N. W. Yunnan, in pine woods near Haba S. E. of Dschungdien, 2650 m, HANDEL-MAZZETTI 4414 (V), the living plant was light-ochraceous, on *Loranthus caloreas* (= *Taxillus Kaempferi*).

LUZON. Zambales Prov., CUMING 1960 (V); Rizal Prov., Mt. Kanumay, 5 X 1911, on *Taxillus chinensis* coll. RAMOS 1020 (BM); Laguna, Los Baños, VIII 1917, COPELAND 618117 (UC), "on *Loranthus*"; Mt. Maquiling, VI—VII 1927, ELMER 17777 (B, H, M, L, U, UC), "on *Loranthus estipitatus*" (= *Taxillus chinensis*), *types* of *Viscum Loranthi* ELMER.

SUMATRA. Fort de Kock, 920 m, JACOBSON 19B, 2044, and 2162 (B), on *Scurrula ferruginea*.

13. **Viscum ovalifolium** A. P. DE CANDOLLE, Prodr., 4 (1830) 278.

For the synonymy of this species see Bull. Jard. Bot. Buitenzorg, sér. 3, XVI, 1 (1938) 48—50. To this must be added:

Viscum orientale BENTHAM, in HOOKER, Lond. Journ. Bot., 2 (1843) 222; BRANDIS, For. Fl. N.W. & Centr. Ind. (1874) 393, p.p.; GAMBLE, in Journ. As. Soc. Bengal, 75, II (1914) 386, cum var. *ovalifolio*; LECOMTE, Not. syst., 3, p. 172 (1915) cum var. *verruculosa*; *Viscum ovalifolium* DANSER, in Blumea, III, 1 (1938) 34—36, 58, t. I, p.p.; in Bull. Jard. Bot. Buitenzorg, sér. 3, XVI, 1 (1938) 48; in Blumea, III, 3 (1940) 401; *Viscum monoicum* GRIFFITH, Not. pl. as., 4 (1854) 637; Ic. pl. as., 4 (1854) 631; Probably also: *Viscum birmanicum* GANDOGER, in Bull. Soc. Bot. Fr., 65 (1918) 33; *Viscum verruculosum* (non WIGHT & ARNOTT) BLAKELY, Proc. Roy. Soc. Queensl., 34 (1922) 29.

From the same list must be cancelled: *Viscum navicellatum* (non KORTHALS) MOLKENBOER, in MIQUEL, Pl. Junghuhn., p. 108 (1852), which represents *Viscum orientale*.

Now that I have learned to distinguish this species from its allies, especially from *V. orientale*, with which it had been confounded by all authors writing on the *Visca* of the Malay Archipelago (cfr. Bull. Jard.

Bot. Buitenzorg, sér. 3, XVI, p. 48—51), it appears to have a very characteristic and continuous area of distribution. It is found in the whole Malay Archipelago from Luzon and Sumatra to New Guinea, and reaches its north-eastern limit in Ava (Burma) and Chiengmai (Siam). In China it is restricted to Hainan and Hongkong. In Formosa, and South and East of New Guinea, it appears to be absent.

Specimens examined:

INDIA. Burma, Ava, Mt. Paong Dong, WALLICH 494 (K), *type* of *Viscum obtusatum* WALLICH; Bassein Distr., Sebyauk Reserve, ROGERS 51 (DD), "on *Rhizophora mucronata*"; Bassein Distr., Kyaukpya Chaung, sea level, PARKINSON 8717 (DD), "on *Rhizophora*, foliage light green, flowers pale yellow, small, fruits greenish"; Moulmein, LOBB 168 and 379 (K); Tavoy, Heinze Reserve, PARKER 2190 (DD), "on *Croton*"; Mergui, MEEBOLD 14317 (BD).

For more southern localities in the Malay Peninsula, cfr. Bull. Jard. Bot. Buitenzorg, sér. 3, XI, p. 468, among which WALLICH 489 (BM, K), *type* of *Viscum ovalifolium*.

CHINA. Without exact locality: MILLETT s. n. (K); GAUDICHAUD s. n. (BD); Kwangsi prov., Lin Shan Shen, 150 m, SIN & WHANG 141 (BD); Hongkong, CHAMPION 402 (K); WRIGHT 181, 182 (K); woods at Little Hongkong, WILFORD 286 (K); Hainan, TUTCHER 2208 (K); A. HENRY 8420 (BD, K); Canton Christian College 9265 coll. McCLURE (K); Dung Ka, 2400 ft, CHUN & TSO 43963 (Göt, H), "fruit green, echinate"; Yaichow, LIANG 62185 (Göt), "fruit green"; Po-ting, 1000 ft, Herb. Arnold Arboretum 72651 coll. HOW (B); Ma Augza Volcano, Hoihow, in ancient shallow crater, HANCOCK 37 (K); Lam Ko Distr., Lin Fa Shan and vicinity, Sung Ka, Kai Tsui Ki Shang, Herb. Lingnan University 15930 coll. TSANG WAI-TAK 431 (BD, K); Taam-chau Distr., Nodoa and vicinity, Lok Tong Ki Shang, Herb. Lingnan University 15553 coll. TSANG WAI-TAK 54 (BD, K); Taam-chau Distr., Shui Mei River, Ki Shang, Herb. Lingnan Univ. 16161 coll. TSANG WAI-TAK 662 (BD, K).

INDO-CHINA AND SIAM. See Bull. Jard. Bot. Buitenzorg, sér. 3, XVI, p. 50—51.

PHILIPPINE ISLANDS. See Philipp. Journ. Science, 58, p. 140, under *V. orientale*.

FURTHER MALAY ARCHIPELAGO. See Bull. Jard. Bot. Buitenzorg, sér. 3, XI, p. 468—469; Rec. Trav. Bot. Néerl., XXXI, p. 758, under *V. orientale*; Blumea, III, p. 401.

14. Viscum Wrayi GAMBLE, in Kew Bull. 1913 (1913) 47.

For this species see Bull. Jard. Bot. Buitenzorg, sér. 3, XI, p. 470.

After having once more studied this species and compared it with its allies, I am more than ever convinced that it is a separate species, readily distinguished from all its congeners by means of the characters given in the determination key on page 266.

To the distribution may be added:

MALAY PENINSULA. Johore, 13.5 mile Mawai-Jemulang Road, low alt., Singapore Field No. 28992 coll. CORNER (B), on *Gomphia corymbosa*.

15. Viscum Acaciae DANSER, n. sp.— Vide *tab. I.* — Omnis glabra. *Caules* graciles, parte basali fere omnibus nodis dichotomi, apices versus minus ramosi vel ramis oppositis, raro passim ramo singulo adventicio: internodia omnia levia vel longitudinaliter costulata, inferiora teretia apice basique incrassata, 3—7 cm longa, nodis ad 5 mm crassis, medio 3—1 mm diametro, superiora gradatim tenuiora et breviora, nodis dilatatis nec incrassatis, terminalia 2—4 cm longa, 0.6 mm diametro, nodis ad 2 mm dilatatis. *Folia* lanceolata vel subspathulata, basi sensim in partem petioliformem 2—5 mm longam attenuata, plerumque 3.5—7 cm longa, 7—20 mm lata, apice rotundata, tenuiter coriacea, utrinque haud lucida, nervis longitudinalibus 3 plerumque distinctis. *Inflorescentiae* singulae vel paulatim in axillis defoliatis, versus apices ramulorum numerosiores ibique passim terminalis et laterales in ramulis defoliatis, ergo subracemosae, cymae triflorae pedunculatae, flore medio femineo, lateralibus masculis; pedunculus tempore florendi brevis, circ. 1 mm longus, post anthesin auctus, denique 3—4 mm longus, 0.3—0.5 mm crassus; bracteae connatae in naviculam initio 1 mm denique 2 mm longam, apicibus acutis. *Flos femineus* oblongo-clavatus, circ. 2—3 mm longus, 1 mm diametro, 4-tepalus. *Flores masculi* in axillis bractearum, ad 0.7 mm longi, nonnihil compressi, aperti ignoti. *Fructus* singuli in inflorescentiis, clavati, parte superiore subglobosa vel nonnihil ellipsoide, ad 6 mm longa 4.5 mm diametro, basi subabrupte in stipitem 2—3 mm longum ad 0.6 mm diametro attenuati, apice stylo breve coronati, immaturi in herbario superficie rugulosa, semilucida, haud verruculosa neque granulosa, maturi superficie sub lente minutissime granulosa. (Description from the specimen ROBERTSON 1823 in the Dehra Dun Herbarium, which is the type of the species.)

R e m a r k s. In general appearance, and especially by its stipitate fruits, this new species shows a superficial resemblance with *Viscum multinerve*, from which it may be readily distinguished by its obtuse, 3-nerved leaves, and especially by the different structure of the inflorescences.

BURMA. Magwe Distr., Ywamun—Shwetandaw, 800 ft, 7 IX 1925, ROBERTSON 1823 (DD), "on *Acacia leucophloea*, berries red", *type* of the species; Upper Burma, Mehtita (?), I 1888, COLLETT 15 (K), "on *Acacia leucophloea*".

16. Viscum indosinense DANSER, in Bull. Jard. Bot. Buitenzorg, sér. 3, XVI, 1 (1938) 51, ic. 2, f; XVI, 3 (1940) p.?

For this species see ll. cc.

17. **Viscum orientale** WILLDENOW, Sp. pl., IV, 2 (1805) 737; PERSOON, Synops., 2 (1807) 613; POIRET, in LAMARCK, Enc. méth., supplem., 2 (1811) 860; SPRENGEL, Syst. veg., 1 (1825) 488, p.p.; A. P. DE CANDOLLE, Prodr., 4 (1830) 278, p.p.; WIGHT & ARNOTT, Prodr. (1834) 379; G. DON, Gen. Hist. Dichl. Pl., 3 (1834) 403, p.p.; OLIVER, in Journ. Linn. Soc., bot., 7 (1864) 103; BRANDIS, For. Fl. N.W. & Centr. India (1874) 393, p.p.; KURZ, For. Fl. Burma, 2 (1877) 324, p.p.?; HOOKER FIL., Fl. Br. Ind., V, 13 (1886) 224, p.p.; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., III, 1 (1898) 195, p.p.; TRIMEN, Handb. Fl. Ceylon, 3 (1895) 471, probab. p.p.; VAN TIEGHEM, in Bull. Soc. Bot. Fr., 43 (1896) 190; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., Nachtr. (1897) 140, p.p.; GAMBLE, Ind. timb. (1902) 584, p.p.; BRANDIS, Ind. trees (1906) 552; COOKE, Fl. Pres. Bombay, II, 3 (1906) 552; TALBOT, For. Fl. Bombay, 2 (1911) 420, p.p.?; HAINES, Botany Bihar & Orissa, 5 (1924) 803; GAMBLE, Fl. Madras, 7 (1925) 1257, 1258; FISCHER, in Rec. Bot. Surv. India, XI, 1 (1926) 161, t. 1, 2, 4; ALSTON, in TRIMEN, Handb. Fl. Ceylon, 6 (1931) 250; DANSER, in Bull. Jard. Bot. Buitenzorg, sér. 3, XVI, 1 (1938) 53, p.p., excl. synonym.; *Viscum verticillatum* ROXBURGH, Fl. ind., ed. 2, III (1832) 764; ed. 3 (1874) 715; *Viscum navicellatum* (non KORTHALS) MOLKENBOER, in MIQUEL, Pl. Junghuhn., 108 (1852); *Viscum verruculosum* (non WIGHT & ARNOTT) TALBOT, For. Fl. Bombay, 2 (1911) 419, p.p.

Stems to more than 45 cm long, terete with swollen nodes, strongly branched, the branches decussate in the lower portion of the plant, but often moreover with additional branches on the nodes, more dichotomously or umbellately arranged towards the extremities of the stems; oldest internodes up to 6 cm long by 6 mm in diameter, smooth or slightly striped; younger internodes gradually less thick and usually somewhat shorter; youngest ones usually 1—3 cm long, to less than 1 mm in diameter, deeply grooved, flattened and dilated to 1.5 or 2 × their width at their apices. *Leaves* normally developed on all the nodes, ovate, contracted into a cuneate basal portion, or more oblong, or somewhat obovate, or roundish, often inaequilateral, always distinctly tapering into a short or very short petiole, usually 2—6 cm long, 0.6—3 cm broad, very obtuse to rounded at the apex, thin-coriaceous, usually with 3 longitudinal nerves that are somewhat more distinct above than beneath; probably always scale-like leaves (prophylls) at the bases of all branchings, which are rarely distinct. *Inflorescences* lateral on the nodes, first single in the axils, later to 6 on each node, moreover terminal on the weak extremities of the twigs,

like the nodes of the stems often papillose by the vaulted epidermal cells, with a peduncle usually 1—5 mm long, angular and grooved and bearing on its apex a boat-shaped cup composed of 2 opposite bracts connate at their bases, together nearly 2 mm long and 0.5 mm deep; usually 5 flowers in each cup, of which the middle 3 female, the lateral ones male; more rarely another pair of bracts above the lower pair, and in that case either a similar set of flowers in the upper cup, or moreover flowers in the axils of the lower bracts; very rarely still a third pair of bracts bearing flowers in the same way, or instead of the second pair a weak leafy twig. *Female flowers* oblong, somewhat angular by pression, with erect, small, triangular tepals. *Male flowers* shorter and more strongly compressed. *Fruits* roundish to oblong-ellipsoidal, in the latter case contracted towards the apex and the base, probably nearly globose when fresh, the largest ones up to 6 mm long by 5 mm in diameter, with the surface velvety-dull by minute granules or papillae, but smooth for the rest, and never with larger papillae nor warts. (Description from plants in the Kew and Dehra Dun Herbaria.)

Remarks. Now that I have learned to distinguish *Viscum orientale* from its allies, especially *Viscum ovalifolium*, it appears to have a rather restricted area of distribution, *viz.*, the Deccan Peninsula south of the Ganges, and Ceylon. Probably it does not occur east of Calcutta, and it certainly does not reach the area of distribution of *Viscum ovalifolium.*

The confusion of *Viscum orientale* with other species seems to start already with SPRENGEL, who included Palestine plants in it that later appeared to belong to the entirely different *Viscum cruciatum.* BLUME, as early as 1823, determined Javan plants as *V. orientale*, and on the ground of specimens distributed by him under that name DE CANDOLLE and subsequent authors included *V. ovalifolium*, so common and widely spread in the Malay Archipelago, in the same species. The *Viscum orientale* mentioned by BENTHAM in his Flora Hongkongensis is likewise *V. ovalifolium*, that of his Flora australiensis is *V. Whitei.* The *V. orientale* of HOOKER's Flora of British India is a mixture of 5 species: 1°, the real *V. orientale*; 2°, specimens of *V. heyneanum* (though this species is also enumerated separately under the name *V. verruculosum*); 3°, specimens of *V. monoicum*, wrongly named because of their leaves, that are neither acute nor falcate; 4°, *Viscum ovalifolium* (though this is mentioned for Burma as a separate species); 5°, the Australian *V. Whitei.* The *Viscum orientale*

of the Ceylon floras often represents *V. heyneanum*, either exclusively or partly.

Specimens examined:

INDIA. Without exact locality: "India orientalis", KLEIN s. n. and DE FRIEDLAND s. n., in Herb. WILLDENOW (BD), the former *type* of *Viscum orientale* WILLDENOW; HEYNE s. n. (BD); ROXBURGH s. n. (K), *"Viscum verticillatum"*; WALLICH 491B (K), "Herb. WIGHT", 491C (K), *"Viscum Thespesiae* Hb. WIGHT"; WALLICH 491 (K); *"Viscum orientale* ? var. *angustum* WALL. Cat. 491E" (BD, K, L), "ex Herb. Heyneano mst. WALL."; Herb. WIGHT 46 (BD, DD, L); WIGHT 1219 (BD).

Ceylon. Jaffna, seashore, HOLTERMANN s. n. (BD); Batticaloa, coll. ? s. n. (DD); Dimboda, THWAITES C. P. 412 (K).

"Peninsula Indiae Orientalis", Herb. WIGHT 1219 (P), *"Viscum orientale"*; "In itinere Madraspatensi, Iuly 1804", ROTTLER s. n. (K), *"Viscum Indicum* Nob."; Sammulcottah, III 1811, and 29 IV, HEYNE s. n. (K), *"Viscum Indicum* nob." (scripsit ROTTLER); Post (?), near Tapoor, 31 III 1806, "cum *V. Ind.* Nob. idem videtr.", ROTTLER s. n. (K); Madras, WIGHT s. n. (K); "Mont. Nilghiri & Kurg, reg. trop.", G. THOMSON s. n. (BD, K, L, P); Iamalai, R. W(IGHT?) s. n. (DD); Kotagiri Ghaut (?), 16¾ milestone, BARBER 8648 (K); Nilgherries, Gudalur, 5000 ft, MEEBOLD 11484 (BD); Katagherry, ADAM s. n. (K); Coimbatore, WIGHT 46 = Kew Distr. 1249 (K); Coimbatore Distr., locality illegible, 1500 ft, FISCHER 1923 (DD); Mettapalayam, BARBER 8549 (K); Chengapalli, BOURNE 5076 (K); Madras, Cuddapah, Thanakonda, 1000 ft, GAMBLE 21206 (K); Madras, Sadras, Chengalpat, BOURNE s. n. et 2875 (K); Godavari Distr., Annavaram, BARBER (?) 12609 (K); Pulomamri, 500 ft, GAMBLE 15866 (K); Vizagapatam Distr., Karaka, BARBER 1609 (K); Tinnevelly, Mundanthorai Ghaut, BARBER 2786 (K); Nellore Distr., Ramapatam, GAMBLE 12380 (DD); Ganjam Distr., Kaliyaguda, 1500 ft, GAMBLE 13837 (K); Tickapalli to Linepada, BARBER 1205 (K); North Kanara, Dodmune, TALBOT 3573 (DD); Central Provinces, Raipur, Balod & Dhamtari Ranges, HAINES 3500 (K); Chutia Nagpur, WOOD s. n. (DD); Kumarbera, Saranda, GAMBLE 9106 (DD, K); Hazaribagh, VICARY s. n. (K); 2000 ft, MEEBOLD 5024 (BD, K); Sumbhulpore, GRIFFITH s. n. (K); Angul, HAINES 5235 coll. CHATTERJEE 16 (K); Singhbhum, HAINES 349 (DD, K); base of Mt. Parasnath, HOOKER (?) s. n. (K); Calcutta, Mutlah, CLARKE 21652 (K); East Bengal, Khasi, GRIFFITH 2738 (K), to which HOOKER remarks: "probably wrong label"; the same number in (P) labelled "Birma & Malay Peninsula".

18. **Viscum heyneanum** A. P. DE CANDOLLE, Prodr., 4 (1830) 278; G. DON, Gen. Hist. Dichl. Pl., 3 (1834) 403; DANSER, in Bull. Jard. Bot. Buitenzorg, sér. 3, XVI, 1 (1938) 51; *Viscum verruculosum* WIGHT & ARNOTT, Prodr. Fl. Pen. Ind. Or. (1834) 379; WALPERS, Repert., 2 (1843) 437; HOOKER FIL., Fl. Br. Ind., V, 13 (1886) 224; VAN TIEGHEM, Bull. Soc. Bot. Fr., 43 (1896) 190; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., Nachtr. (1897) 140; GAMBLE, Ind. timb. (1902) 584; BRANDIS, Ind. trees (1906) 552; GAMBLE, Fl. Madras, 7 (1925) 1257, 1258; FISCHER, in Rec. Bot. Surv. India, XI, 1 (1926) 180 seq.;

ALSTON, in TRIMEN, Handb. Fl. Ceylon, 6 (1931) 250; ENGLER & KRAUSE, in ENGL., Nat. Pflanzenfam., ed. 2, 16b (1935) 201; *Viscum orbiculatum* WIGHT, Ic. pl., III, 3 (1845) 13, t. 1016; WALPERS, Annales, I (1848) 361; HOOKER FIL., Fl. Br. Ind., V, 13 (1886) 224; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., III, 1 (1889) 167; VAN TIEGHEM, in Bull. Soc. Bot. Fr., 43 (1896) 190; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., Nachtr. (1897) 140; GAMBLE, Ind. timb. (1902) 594; BRANDIS, Ind. trees (1906) 552; GAMBLE, Fl. Madras, 7 (1925) 1257, 1258; FISCHER, in Rec. Bot. Surv. India, XI, 1 (1926) 181 seq.; ENGLER & KRAUSE, in ENGL., Nat. Pflanzenfam., ed. 2, 16b (1935) 201; *Viscum orientale* (non WILLDENOW) THWAITES, Enum. pl. Zeylan. (1859) 136; BRANDIS, For. Fl. N.W. & Centr. India (1874) 393, p.p.; TRIMEN, Syst. Catal. Ceylon (1885) 77; HOOKER FIL., Fl. Br. Ind., V, 13 (1886) 224, p.p.; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., III, 1 (1889) 195, p.p.; TRIMEN, Handb. Fl. Ceylon, 3 (1895) 471; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., Nachtr. (1897) 140, p.p.; *Viscum capitellatum* (non SMITH) LECOMTE, Not. syst., 3, p. 171 (1915); Fl. Indo-Chine, V, 3 (1915) 209.

Stems to 40 cm and more long, strongly branched, in the lower portion with decussate branches, or moreover with additional branches on the nodes, often dichotomously or umbellately branched towards the extremities; lower articulations terete, usually up to 4 cm long by 5 mm in diameter, their nodes thickened in all directions or with two opposite tubercles, the upper ones gradually less thick, more angular, also somewhat shorter, the uppermost ones usually 1—2 cm long, angular and grooved, their nodes gradually flattened and dilated towards the apex to twice the width. *Leaves* sessile or subsessile, very variable as regards the shape, roundish-ovate to obovate or nearly cuneate-obovate, or elliptic to oblong-lanceolate, usually 1.5—5 cm long, 0.8—3 cm broad, acute to rounded at the apex, attenuate to contracted into the base, often with a finely crisp margin, thickish, thick-chartaceous to thin-coriaceous in the dry state, dull above and beneath or somewhat shining above, with 3—5 longitudinal nerves which often are connected by a distinct network of fine prominent veins, the whole nervation usually more distinct above than beneath. *Inflorescences* very rarely terminal, nearly always lateral, axillary or up to 6 together on the nodes, short-peduncled cymes with 3—7 sessile flowers sustended by 2 bracts, very rarely with another flower-bearing internode, the peduncle 0—2 mm long, angular and grooved, the bracts united into a boat-shaped cup, which is 1.5—2 mm long, acute or

obtuse, and very short at the sides, the outer flowers usually male, the others usually female. Young *fruits* oblong, attenuate towards both ends, dull and slightly finely papillose and moreover usually with rather long warts, the older fruits less attenuate and less warted, perhaps entirely smooth at length, up to 5 mm long by 2 mm in diameter, often crowned by the persistent tepals. (Description from Indian specimens listed below).

Remarks. *Viscum heyneanum* is, in some respects, intermediary between *V. orientale* and *V. monoicum*, in other respects not, but careful attention is often needed to distinguish it from both. As regards the general appearance, it is very similar to *V. orientale*, but it is, averagely, smaller in all parts. The stems are nearly as in *V. orientale*, but the young internodes are, usually, more strongly flattened, more gradually dilated from the base to the apex, more abruptly dilated at the apex. The leaves are not only somewhat smaller averagely, but also more obtuse than in *V. orientale*; the number of longitudinal nerves is 3 to 5, as in *V. orientale*, but it is more often 5 than in the latter species; also the reticulate veins between them are often more distinct in *V. heyneanum* than in *V. orientale*. The inflorescences are mainly as in *V. orientale*, but they are always short-peduncled or even subsessile, and very rarely have more than one flower-bearing internode, as is so often the case in *V. orientale*. The young fruits furnish the best distinctive character: they are oblong, attenuate towards both ends, somewhat dull by the slightly papillose surface, but much less so than in *V. orientale*, and moreover warty: the warts, however, may be very different in number and development, and become less distinct in the ripe fruit; in that case the fruit becomes similar to that of *V. monoicum*, but this species has the fruits less attenuate towards the base and not at all so towards the nearly truncate apex. The tepals are more often persistent in *V. heyneanum* than in allied species, but it seems that this peculiarity is caused or influenced by the dryness of the climate.

HOOKER places the name *V. heyneanum* among the synonyms of *V. orientale*, and, consequently, uses the younger specific name *verruculosum* for our species. This may be caused by the fact, that we find the name *V. heyneanum* written, in a handwriting unknown to the present author, on several sheets with *V. orientale* in the Kew Herbarium. The same name, however, also occurs in the Kew Herbarium, in the same handwriting, on a few sheets with *V. verruculosum*, and DE CANDOLLE's type specimen preserved in Geneva, cer-

tainly is no *V. orientale*, as it has rather strongly warted fruits. The fact that DE CANDOLLE, in his Prodromus, does not mention the warts of the fruits at all, may have confirmed HOOKER in his belief, that the plant described by DE CANDOLLE was *V. orientale*.

HOOKER, in his Flora of British India, accepts *V. orbiculatum* as a distinct species, and expresses his doubt as to whether it is not a form of *V. orientale*. GAMBLE, in his Flora of Madras, likewise accepts *V. orbiculatum* as a distinct species, closely allied to *V. verruculosum*, but ascribes to it, as distinctive character, that the fruits are smooth and that the middle flowers of the "triads" are sometimes male. The present author, however, though he will not deny that the latter may be exceptionally the case, did not find the inflorescences of the specimens, named as *V. orbiculatum* by GAMBLE, different from those of *V. heyneanum*, and as the fruits show the same peculiar shape and warty surface, he cannot discover any valid reason to distinguish *V. orbiculatum* from *V. heyneanum*.

Now that the distribution of *V. heyneanum* appears to be destricted to so small an area in the Deccan Peninsula, it appears more doubtful than ever that this species should be collected in Cochin-China (see Bull. Jard. Bot. Buitenzorg, sér. 3, XVI, 51—53).

Specimens examined:

INDIA, without exact locality: WIGHT 45 (BD); WIGHT 47 (L), "*Viscum orientale* var."; WALLICH 491 (K), "*Viscum orientale* LINN. Herb. Heyneanum"; 2500 ft, WALLICH 6875 (BD, K, L).

CEYLON. WALKER s. n. (K); THWAITES C. P. 412 partly (B, BD, P), C. P. 1639 (K); Jaffna, C. HOLTERMANN s. n. (BD); Pointe de Galles, PIERRE 6462 (P), on *Randia*; probably also: Mrs. WALKER s. n. (K); THWAITES C. P. 481 (K); GARDNER 831 (K).

PENINSULAR INDIA. Pondichéry, PERROTTET 325 (P); Courtallem, WIGHT 47 = Kew Distrib. 1250 (K); Tinnevelly Distr., Naterikal, way to Manshola, BARBER (?) 13339 (K); Mt. Anamalay, BEDDOME s. n. (K); Palni Hills, Muliar, ANGLADE 2151 (K); "Mont. Nilghiri & Kurg, reg. trop.", G. THOMSON s. n. (K); Nilgiri Hills, WIGHT 45 = Kew Distr. 1251 (K); WIGHT 51 = Kew Distrib. 1253 (BD, K), probably *types* of *Viscum orbiculatum* WIGHT; Mayaburam, ADAM s. n. (K); Khoondas, HOHENACKER 1480 (BD, K); Bikkatti, 5000 ft, GAMBLE 20669 (DD, K); Avalanché, 7000 ft, GAMBLE 16115 (K); Blackbridge, 6000 ft, GAMBLE 12114 (K); Coimbatore Distr., Maonattam (?) Ghát, LUSHINGTON s. n. (K); Nellore Distr., Ramapatam, GAMBLE 12380 (K); Striharikota, GAMBLE s. n. (K).

Very doubtful (see above): French Indo-China, "Ad Thu-dhau-mot austro-cochinchinae", PIERRE 3081 (P).

Among the specimens examined there were a few with entirely smooth fruits. Perhaps they represent a variety, and in order to draw attention to this form I prefer to distinguish it under a varietal name:

Viscum heyneanum var. **liocarpum** DANSER, nov. var., fructibus verruculis carentibus, omnino levibus.

Madura Distr., Sirumalais, BOURNE 1767 (K); Palni Hills, Poombari Valley, BOURNE 1767 (K); Nilgiris, Kuchgooch (Kaguchi), LAWSON s. n. (K), *type* of the variety: moreover "Galh" or "Gath", CHAMPION s. n. (K).

19. **Viscum monoicum** A. P. DE CANDOLLE, Prodr., 4 (1830) 278; ROXBURGH, Fl. ind., ed. 2, 3 (1832) 763; G. DON, Gen. Hist. Dichl. Pl., 3 (1834) 403; WIGHT & ARNOTT, Prodr. Fl. Pen. Ins. Or. (1834) 379; ROXBURGH, Fl. ind., ed. 3 (1874) 715; BRANDIS, For. Fl. N.W. & Centr. Ind. (1874) 393; KURZ, For. Fl. Burma, 2 (1877) 324; HOOKER FIL., Fl. Brit. Ind., V, 13 (1886) 224, cum var. *Edgeworthii*; CLARKE, in Journ. Linn. Soc., bot., 25 (1889) 64; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., III, 1 (1889) 194; TRIMEN, Handb. Fl. Ceylon, 3 (1895) 471; VAN TIEGHEM, in Bull. Soc. Bot. Fr., 43 (1896) 190; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., Nachtr. (1897) 140; GAMBLE, Ind. timb. (1902) 584; BURKILL, in Rec. Bot. Surv. India, IV, 4 (1904) 77, 129; COOKE, Fl. Bombay, II, 3 (1906) 552, p.p.?; BRANDIS, Ind. trees (1906) 552, 716; RIDLEY, in Journ. Straits Branch, Roy. As. Soc., 59 (1911) 164; GAMBLE, in Journ. As. Soc. Bengal, 75, II (1914) 386; DUTHIE, Fl. Upp. Ganget. Plain, III, 1 (1915) 68; LECOMTE, Fl. Indo-Chine, V, 3 (1915) 208; RIDLEY, in Journ. Fed. Mal. States Mus., X, 2 (1920) 114; HAINES, Bot. Bihar & Orissa, 5 (1924) 803; GAMBLE, Fl. Madras, 7 (1925) 1257, 1258; FISCHER, in Rec. Bot. Surv. India, XI, 1 (1926) 161 seq.; COWAN, in Rec. Bot. Surv. Ind., XI, 2 (1928) 221; KANJILAL, For. Fl. Pilibhit &c. (1933) 319; ENGLER & KRAUSE, in ENGL., Nat. Pflanzenfam., ed. 2, 16b (1935) 201; *Viscum falcatum* A. P. DE CANDOLLE, Prodr., 4 (1830) 278; G. DON, Gen. Hist. Dichl. Pl., 3 (1834) 403; VAN TIEGHEM, in Bull. Soc. Bot. Fr., 43 (1896) 190; *Viscum confertum* ROXBURGH, Fl. ind., ed. 2, 3 (1832) 764; ed. 3 (1874) 715; *Viscum Benghalensis* ROXBURGH, ex W. & A., Prodr. (1834) 379, in synonymis; *Viscum Edgeworthii* BRANDIS, Ind. trees (1906) 552; *Viscum verruculosum* (non W. & A.) TALBOT, For. Fl. Bombay, 2 (1911) 419, p.p.; *Viscum orientale* (non WILLDENOW) DANSER, in Bull. Jard. Bot. Buitenzorg, sér. 3, XVI, 1 (1938) 53, t. 1, ic. 3, d—g.

Stems to 40 cm and more long, strongly branched, more decussately so in the lower part, more dichotomously towards the extremities; twigs terete, at first slightly dilated, later thickened at the nodes, in old stems with decussate tubercles; oldest internodes 2—7 cm long, up to 10 mm in diameter, smooth or longitudinally wrinkled, youngest

ones 1.5 -4 cm long, 0.5—1 mm in diameter at the base, 1.5—2 × as wide at the apex, longitudinally grooved. *Leaves* normally developed on all nodes, moreover a pair of scales (prophylls) at the base of every branching (but not always distinctly visible); leaves sessile or very shortly petioled, elliptic to lanceolate, often somewhat falcate, 2.5—13 cm long, 0.6—4 cm broad, always attenuate at the base, acute or somewhat acuminate towards the obtuse or very obtuse apex, chartaceous to thin-coriaceous, nearly equal above and beneath, dull or slightly shining, with usually 5, more rarely 3 or 7 longitudinal nerves and between these distinct or indistinct connecting veins. *Inflorescences* rarely terminal on weak twigs, usually lateral, at first single in the axils with the bracts in one plane with the stem and the leaf, later more numerous (usually up to 6) on the nodes, peduncled cymes with one or more pairs of scales at the base and one pair of bracts at the tip, and, included by the latter, usually 5, more rarely 3 or 7, sessile flowers, the outer ones of which are male, the others female; peduncle 0—2 mm long, usually very short; bracts connate into a boat-shaped whole which at first is 1.5—2 mm, later up to 4 mm long, and 0.5—0.75 mm deep. *Female flowers* clavate or obovate, nearly 1.5 mm long, with 4 erect short-triangular tepals. *Male flowers* shorter, nearly 1 mm long, usually oblong, compressed. *Fruits* usually oblong, truncate at the apex, attenuate to rounded at the base, up to 4—6 mm long, 2—3 mm in diameter, smooth with exception of the wrinkles caused by drying. (Description from the British Indian materials under mentioned.)

Remarks. The only difference to be depended on, between *Viscum monoicum* and its nearest allies with more than 3-flowered inflorescences, is in the oblong, almost truncate, entirely smooth fruits. When fruits are absent the species may be distinguished by its leaves, which are usually 5-nerved, more rarely 3- or 7-nerved. In *V. orientale* and *V. heyneanum* the leaves are usually 3-nerved, more rarely 5-nerved, in *V. multinerve* the longitudinal nerves of the leaves are much more numerous.

Specimens examined:

INDIA. Ceylon, Ella Uva, HOLTERMANN s.n. (BD); Madras, Trao, Udambanshola, 5000 ft, MEEBOLD 13034 (BD); "Mont. Nilghiri & Kurg, reg. trop.", THOMSON s.n. (BD, K); Godavari Distr., Rumpa Hill, 2000 ft, GAMBLE 16012 (DD); Vizagapatam, Kurubapalli Ghát, 3500 ft, LUSHINGTON s.n. (K); North Kanara, Kumbhaswada, SEDGWICK 3889 coll. BELL (DD); Yellapore, TALBOT 780 (K); Bundelkhand, Banda, EDGEWORTH 4006 (K), *types* of the var. *Edgeworthii* HOOKER FIL.; Bahraich Distr., SRI RAM s.n. (DD); Gorakhpur Distr., Sakhai, SRI

RAM s. n. (DD); Gorakhpur, VICARY s. n. (K); Upper Gangetic Plain, Nepal frontier, Khairbatti Nala, INAYAT 23819 (BD, DD); Koomargaon, W. Duars, GAMBLE 6640 (DD), 6668 (K); Chutia Nagpur, Amjeria Tori, Lohardaga, 2000 ft, GAMBLE 8711 (DD, K); Jona, PRAIN s. n. (B); Pitorea, 2000—2500 ft, WOOD s. n. (K); Ranchi Distr., Adar, HAINES 5234 (K); Purulia, 750 ft, CLARKE 20806 (K); Sikkim, lower hills, Simsibong (?), 2—4000 ft, HOOKER s. n. (K); Behar, Monghyr, LOCKWOOD s. n. (K); East of Chandna (?), HAINES 2373 (K); Calcutta, WALLICH s. n. (G); "Sillet et Mont. Pundua", WALLICH 492 (BD, K), originals of *Viscum falcatum* WALLICH; "Mont. Pundua", WALLICH s. n. (G), *type* of *Viscum falcatum* DE CANDOLLE; Sunderbans, HEINIG s. n. (B, DD, P); Sunderbans, Bhoma Khali, BHATTACHARYAY 11 (DD); Bengal, Mymensingh, Shooshung, sea level, CLARKE 17290 (B); Assam, Khasi & Jyntea Hills, Barpani, 3200 ft, KANJILAL 6115 (DD); Silhet, WALLICH 492, 492e, 492E (P), originals of *Viscum falcatum* WALLICH; Khasia, 0—3000 ft, HOOKER & THOMSON s. n. (BD, K, L, P); Chittagong station, CLARKE s. n. (K); Rangoon Distr., Kamayut, PARKINSON 14855 (DD); Rangoon, PARKER 2781 (BD, DD), on the plant in DD a small specimen of *Viscum articulatum*; Rangoon, University Avenue, host of PARKINSON 14391 (K), which is *Viscum articulatum*; Tenasserim, Tavoy, WALLICH s. n. (G); Mergui, GRIFFITH 601 (K); Mergui Distr., Theinkun, PARKER 2576 (BD, DD).

FRENCH INDO-CHINA AND SIAM. See Bull. Jard. Bot. Buitenzorg, sér. 3, XVI, 1, p. 55 (under *V. orientale*); XVI, 3, p. ?

20. **Viscum multinerve** HAYATA — *Viscum orientale* var. *multinerve* HAYATA, in Bot. Mag. Tokyo, 20 (1906) 72; in Journ. Coll. Sc., Imp. Univ. Tokyo, 25 = Fl. montan. Formos. (1908) 192; KAWAKAMI, List Pl. Formosa (1910) 97; *Viscum multinerve* HAYATA, Ic. pl. Formos., 5 (1915) 196, ic. 73; ENGLER & KRAUSE, in ENGL., Nat. Pflanzenfam., ed. 2, 16b (1935) 201; *Viscum stipitatum* LECOMTE, in SARGENT, Pl. Wilson., III, 2 (1916) 319; LÉVEILLÉ, Cat. pl. Yun-Nan (1916) 285; GROFF, DING, & GROFF, in Lingnaam Agric. Rev., I, 2 (1924) 76; DANSER, in Bull. Jard. Bot. Buitenzorg, sér. 3, XVI, 1 (1938) 55; XVI, 3 (1940) p. ?

For a description see DANSER, l. c. 1938, p. 55.

Specimens examined:

CHINA. Yunnan, Szemao, 5000 ft, A. HENRY 12758 (K), *type* of *Viscum stipitatum* LECOMTE; Yunnan-sen Distr., Kiang-ti, CAVALERIE 4201 (K); Kwantung, Yunfou Distr., WANG 520 (K, L, P, S); Kwantung, Winfoo, 110 m, SIN 5350 (BD, ex Hb. Sun Yatsen Univ.); Kwangsi, Yao Shan, SIN 3974 (BD); Hainan, TSANG & FUNG 18073 (DD); Yaichow, LIANG 63210 (Göt), shaded forest, fruit green; Five Finger Mt., Canton Christian College Herb. 9560 coll. MCCLURE (K, P), wooded ravine, $^2/_3$ m high.

FRENCH INDO-CHINA & SIAM. See Bull. Jard. Bot. Buitenzorg, sér. 3, XVI, 55, (under *V. stipitatum*).

FORMOSA. Prov. Nanto, Musha, 500—3000 m, E. H. WILSON 10109 (K); (Jitsugetsutan, NAKAHARA s. n., *type* of *Viscum multinerve*, ex HAYATA, in Bot. Mag. Tokyo, 20, p. 72).

21. Viscum trilobatum TALBOT, For. Fl. Bombay, 2 (1911) 419, ic. 479; *Viscum capitellatum* (non SMITH) HOOKER FIL., Fl. Br. Ind., V, 13 (1886) 225, p.p.; COOKE, Fl. Bombay, II, 3 (1906) 552, p.p.; GAMBLE, Fl. Madras, 7 (1925) 1257, 1258, p.p. — Vide *tab. III.*

Stems rather short and rigid, to 25 cm long and more, decussately branched in the lower portion, more dichotomously towards the extremities by the development of terminal inflorescences; lower internodes terete with thickened nodes, up to 6 cm long, to 5 mm in diameter, the middle ones sometimes a little longer, gradually less thick, slightly angular, the upper ones usually 1.5—4 cm long, angular-grooved, usually 1—2 mm in diameter at the base, gradually flattened and dilated to 1.5 or 2 × the width towards the apex, once more abruptly dilated to 1.5 or 2 × at the node. *Leaves* normally developed, sessile with narrow base or with a petiole up to 3 mm long, which is flat above, nearly flat or slightly rounded beneath; lamina obovate to suborbicular or sometimes more cuneate and subtruncate, abruptly or gradually contracted into the base, 1.5—4.5 cm long, 1—4 cm broad, coriaceous, dull or slightly shining, nerveless or with 3—5 longitudinal nerves and indistinct veins, which are sometimes more distinct above than beneath. *Inflorescences* short-peduncled cymes, usually lateral in the lower portion of the plant, single or to 3 in the leaf axils, also terminal, usually in threes, on the extremities of the stems, the peduncle bearing at its tip a boat-shaped bracteal cup and usually 3 flowers, the lateral ones of which are female, the middle ones male, more rarely all female; rarely instead of the middle flower a second internode bearing a bracteal cup with one male and two female flowers; peduncle usually 0—2 mm long and more than 1 mm in diameter, in terminal cymes rarely up to 4 mm long; boat-shaped cup 2—4 mm long, usually acute, 0.75—1 mm high in the middle. *Male flowers* obovate, nearly 2 mm long, 1 mm broad, with 4 rounded broad tepals. *Female flowers* oblong, with 4 small erect tepals. *Fruits* as far as known (probably unripe ones only) roundish, up to 5 mm long by 4.5 mm in diameter, somewhat contracted below the tepal-bearing rim, crowned by the very short style. (Description from all the specimens listed below.)

R e m a r k s. When we compare TALBOT's specimens in the Dehra Dun Herbarium, which are labelled *V. capitellatum*, to the drawing in his Flora of Bombay (cfr. *plate III A*), it is evident, that these specimens are types of his *Viscum trilobatum*. When we, furthermore, compare these type specimens, with their cuneate, very slightly trilobate leaves, to the

other ones mentioned below (cfr. also *plate III A to III B*), we must admit that the latter specimens probably represent the more normal leaf shape, and that TALBOT's choice of the specific name was not a happy one.

With the exception of TALBOT, all authors who knew this plant seem to have included *V. trilobatum* in *V. capitellatum*. The present author, however, though acknowledging the close relationship, considers *V. trilobatum* clearly distinct from *V. capitellatum* by its larger leaves and shorter-peduncled cymes, and sharply delimited against is.

Specimens examined:

INDIA. Deccan Peninsula, Nilgiri, Masnigudi, 3000 ft, GAMBLE 15693 (K); Malabar, Chedleth, 3000 ft, FISCHER 329 (DD), "on *Loranthus longiflorus*"; Kanara, Sindolé, RITCHIE 1769 (K), "on *Loranthus loniceroides*"; North Kanara, Ioida, TALBOT s. n. (DD), *types* of *Viscum trilobatum* TALBOT; "N. Kanara district in monsoon and rain-forest growing on different trees" (TALBOT, l. c.).

22. **Viscum capitellatum** SMITH, in REES, Cyclopedia, vol. 37, *Viscum* no. 18 (1817); A. P. DE CANDOLLE, Prodr., 4 (1830) 279; G. DON, Gen. Hist. Dichl. Pl., 3 (1834) 404; WIGHT & ARNOTT, Prodr. Fl. Penins. Ind. Or. (1834) 380; WALPERS, Repert., 2 (1843) 437; THWAITES, Enum. Pl. Zeylan. (1859) 136; CHALON, Rev. Loranth. (1870) 67; TRIMEN, Syst. Catal. Ceylon (1885) 77; HOOKER FIL., Fl. Br. Ind., V, 13 (1886) 225, p.p.; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., III, 1 (1889) 195; TRIMEN, Handb. Fl. Ceylon, 3 (1895) 471; VAN TIEGHEM, in Bull. Soc. Bot. Fr., 43 (1896) 190; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., Nachtr. (1897) 140; GAMBLE, Ind. timbers (1902) 584; BRANDIS, Ind. trees (1906) 552; COOKE, Fl. Bombay, II, 3 (1906) 552, p.p.; TALBOT, For. Fl. Bombay, 2 (1911) 421, ic. 480; GAMBLE, Fl. Madras, 7 (1925) 1257, 1258, p.p.; FISCHER, in Rec. Bot. Surv. India, XI, 1 (1926) 171 seq.; ENGLER & KRAUSE, in ENGL., Nat. Pflanzenfam., ed. 2, 16b (1935) 201. — Vide *tab. II, B.*

Stems short, rigid, to 15 cm long or somewhat longer, usually shorter, strongly branched, the branches of the lower portion decussate, divaricate, those of the upper portion of the plant more umbellately arranged; lower internodes terete, smooth or wrinkled, up to 5 mm in diameter, thickened at the nodes, the upper ones up to 6 cm long, usually shorter, terete, wrinkled, less thick, dilated and flattened at the tip, the uppermost ones less thick and shorter and more distinctly dilated and flattened at the tip, usually 1—2 cm long, 1—1.5 mm in diameter at the base, 1.5—2.5 × as broad upwards, sometimes rather distinctly grooved, usually wrinkled only, once more abruptly dilated at the tip to 1.5 or 2 × the breadth. *Leaves* partly normally developed,

partly reduced to scales (the scales at the bases of the ramifications indistinct or absent), especially towards the base of the plant and the extremities of the stems, rarely the whole plant leafless, but in that case the normal leaves probably fallen off; normal leaves roundish-obovate, thickish, dull, always curled upwards, without visible nerves, usually 1.5—2 cm long, often smaller, always rounded at the apex, strongly contracted at the base, sessile. *Inflorescences* lateral, axillary or to 6 around the nodes, hardly ever terminal, always with a long peduncle bearing at its apex a boat-shaped cup formed by two bracts connate at their bases, and in this cup at first one, later up to 5 flowers, finally with 4 fruits and without middle flower, which is probably male; rarely instead of the middle flower a pedicellate flower with a pair of bracts of its own; peduncles 2—10 mm long; bracteal cups 2.5—4 mm long, acute. *Male flower* obovate, nearly 2 mm long, 1 mm broad, with short tepals and obconic base. *Female flowers* more oblong, with ellipsoid ovary and small erect tepals. *Fruits* (as far as known, certainly unripe) roundish-ellipsoid, up to 3.5 mm long, 2.5 mm in diameter, contracted under the tepal-bearing margin, wrinkled (by drying) but smooth and shining for the rest. (Description from specimens in the Kew and Dehra Dun Herbaria.)

Remarks. Though this species seems to be common in several regions, the specimens in the herbaria examined by the author are scanty. From these materials, however, it is sufficiently evident, that the young plants have normal leaves on most of the nodes, but that the leaves are often scale-like towards the base of the plant and towards the extremities; older plants usually have their normal leaves fallen off for the greater part and look almost leaf-less. From this it is evident, that WALKER & ARNOTT's varieties α and β deserve no varietal name.

I have separated from this species the specimens from North Kanara distinguished by TALBOT as *Viscum trilobatum*, and considered by several authors as a variety of *V. capitellatum*.

Specimens examined:

INDIA. Ceylon, Peradenia, THWAITES C. P. 1638 (BD, K, P), on *Dendrophthoë*; "Peninsula Indiae Orientalis", ex Herb. WIGHT s. n., WIGHT Catal. 1223, "*Viscum capitellatum* SM. α = *Viscum Mangiferae* WALL. L. n. 6878 (BD, K, P); *ibidem*, Herb. WIGHT 54 = WIGHT Catal. 1224 *Viscum capitellatum* SM. β *subaphyllum* — Kew Distrib. 1252 (K, P), on *Dendrophthoë falcata*; "Örawur", ex Herb. ROTTLER s. n., "*Viscum umbellatum* nob." (K); Coimbatore Distr., Iruttupallam (?), BARBER 8552 (K), on *Dendrophthoe falcata*, "which was on *Salvadora persica* L."; Western Peninsula from the Konkan southwards, Ceylon; commonly parasitic on *Loranthus*

longiflorus and other species of *Loranthus* in monsoon or rain-forest; also on *Terminalia paniculata.*" (TALBOT, l. c.).

23. **Viscum Whitei** BLAKELY, in Proc. Linn. Soc. N. S. Wales, 53, 2 (1928) 45, t. 7; *Viscum orientale* (non WILLDENOW) BENTHAM, Fl. austr., 3 (1866) 396; F. v. MUELLER, Syst. cens. (1882) 64; BAILEY, Syn. Queensl. Fl. (1883) 451; HOOKER FIL., Fl. Br. Ind., V, 13 (1886) 224, p.p.; F. v. MUELLER, Sec. syst. cens. (1889) 111; ENGLER, in ENGL. & PR., Nat. Pflanzenfam., III, 1 (1889) 195, p.p.; Nachtr. (1897) 140, p.p.; BAILEY, Compreh. Catal. Queensl. Pl. (1913) 460; DOMIN, Beitr. Fl. Austr., in Bibl. Bot., 22 (1921) 605.

Stems long and slender, over 1 m long, hanging, branched but not strongly so; lower internodes terete, up to 4 mm in diameter, indistinctly ribbed, usually 2—4 cm long, rather strongly thickened at the nodes; upper internodes gradually somewhat longer, often 5—6 cm long, less thick and more distinctly decussately flattened and dilated towards the apex to twice the width, usually 1—1.25 mm in diameter at the base, with 3—5 longitudinal ribs on each side. *Leaves* lanceolate, usually 2—4 cm long, 4—6 mm broad, obtuse or somewhat acute, often mucronulate, attenuate at the base into a 1—2 mm long petiole, dark-coloured (in the herbarium) with 1—3 longitudinal nerves, which usually are visible on the underside only. *Inflorescences* peduncled cymes, usually single, rarely to 3 in the axils, also on the leafless nodes; peduncle 2—12 mm long, 0.25—0.5 mm in diameter at the base, dilated and flattened towards the apex like the internodes of the stem; bracts conduplicate-triangular, acute, slightly uncinate, at first incurved, divaricate or somewhat reflexed later, finally up to 0.75 mm, rarely to 1 mm long, not connate at the base. Flowers 3—5 in each cyme, the middle one male (or sometimes female?), the lateral ones always female. *Male flowers* flattened by pressure of the adjacent flowers, apparently 2-valved, rhomboid-spathulate, nearly 1.25 mm long, soon caducous. *Female flowers* cylindrical, nearly 2 mm long, of which the tepals occupy about one-third. *Fruits* 1—3 in each cyme, the largest ones nearly globose, up to 4 mm in diameter, crowned by the short style, hardly stipitate at the base, wrinkled by drying but smooth and shining for the rest. (Description from the under mentioned specimens.)

Remarks. In many respects, especially in the peculiar structure of the inflorescences, *V. Whitei* is closely allied to *V. Bancrofti*. It differs from this species not only by its well-developed leaves, but also by the larger dimensions of its vegetative parts. Among the

Asiatic species, *V. trilobatum* and *V. capitellatum* are very near by the similar structure of the inflorescences. I could not discover, on the specimens examined, the peculiar stripes on the fruits described and figured by BLAKELY.

Specimens examined:

AUSTRALIA. Queensland, F. v. MUELLER s. n. (BD); Rockhampton, DIETRICH s. n. (BD). (See also BLAKELY, l. c., who, moreover, quotes BANCROFT s. n., the *type* of the species.)

24. Viscum Bancrofti BLAKELY, in Proc. Linn. Soc. N. S. Wales, 53, 2 (1928) 46, t. 8.

Stems slender, pendulous, strongly branched with decussate branches; lower internodes terete, indistinctly longitudinally ribbed, up to 3.5 cm long by 2.5 mm in diameter, slightly thickened at the nodes; upper ones gradually shorter, to less than 2 cm long, gradually less thick, to less than 0.25 mm at the base, distinctly flattened and dilated towards the apex to twice the width, usually with 3 strong ribs on both sides. *Leaves* all scale-like, those at the bases of the branches (prophylls) very small, triangular, often invisible; those at the apices of the internodes acute, conduplicate-triangular or claw-shaped, here and there up to 1 mm long or even slightly longer, usually somewhat shorter, connected at their bases by a short but distinct limb. *Inflorescences* pedunculate, single in the axils, lateral, or sometimes terminal on weak twigs; peduncles usually 1—5 mm long, like the internodes of the stem dilated to twice the width and flattened towards the apex from a terete base; bracts divaricate, acute, connate to a boat-shaped cup 2 mm long. *Male flowers* not seen (see BLAKELY's description) but certainly not all the cymes with the middle flower male; middle flower often, lateral flowers usually or always *female*, with a cylindrical nearly 1 mm long ovary and a very small perigone hardly covering the small style and soon falling off. *Fruits* 1—3 in each cyme, roundish-ellipsoid, not or hardly stipitate, the largest ones up to 3 mm long, nearly 2 mm in diameter, strongly wrinkled by drying, but smooth and shining for the rest. (Description from the under mentioned specimens.)

Remarks. Only superficially resembling *Viscum articulatum* and its nearest allies, and easily distinguished from them by the entirely different inflorescences.

Specimens examined:

AUSTRALIA. Queensland, DIETRICH s. n. (BD). (See also BLAKELY, *l. c.*, who only gives BANCROFT no. 11, the *type*, from Eidsvold, parasitic on *Loranthus Quandang* var. *Bancrofti*.)

Visca dubia et excludenda.

In the following list of forms, which mainly have been described or mentioned as *Viscum*, but in reality belong to other genera, I omit those already mentioned in my former revisions of *Loranthaceae*, viz., those of the Netherlands Indies and adjacent regions (Bull. Jard. Bot. Buitenzorg, sér. 3, XI, 3—4, 1931), the Philippine Islands (Phil. Journ. Sc., 58, 1, 1935), French Indo-China and Siam (ibid., XVI, 1, 1938, and XVI, 3, 1940), and that of the genus *Korthalsella* (ibid., XIV, 2, 1937, and XVI, 3, 1940). In the latter genus all forms must be included which are described as *Viscum* from regions East of New Guinea and the Australian Continent, but also many of those from more Western parts of the Old World.

Viscum cornifolium CUNNINGHAM, ex OLIVER, in Journ. Linn. Soc., bot., 7 (1864) 92 = **Notothixos cornifolius** OLIVER.

Viscum floccosum THWAITES, Enum. pl. Zeylan. (1864) 418; OLIVER, in Journ. Linn. Soc., bot., 7 (1864) 92 = **Notothixos floccosus** (THWAITES) OLIVER.

Viscum grossum WIGHT & ARNOTT, Prodr. Fl. Pen. Ind. Or. (1834) 380; WALPERS, Repert., 2 (1843) 437; HOOKER FIL., Fl. Br. Ind., V, 13 (1886) 227.

Specimens examined: Madras, Dindigul Hills (ex WIGHT & ARN., l. c.) Herb. WIGHT 55 = WIGHT Catal. 1226 = WIGHT in WALL. List 6879 (K).

HOOKER rightly says about these specimens: "WIGHT & WALLICH's plants consist of nothing but fragments of branches resembling those of *V. album*. The flowers are described as fascicled at the nodes, but there are none in the specimens." The specimens examined do indeed call to mind *Viscum album*, but also other *Visca*, and most of all *V. capitellatum*. As *V. album* does not occur in the Deccan Peninsula, the remark on the sheet by GAMBLE: "perhaps *V. capitellatum*", may be right.

Viscum Helferi PRESL, Epim. bot. (1851) 256; WALPERS, Annal., 2 (1852) 729; BENTHAM & HOOKER FIL., Gen. pl. III, 1 (1880) 215 = **Ginalloa Helferi** (PRESL) KURZ.

Viscum heteranthum WALLICH, ex A. P. DE CANDOLLE, Prodr., 4 (1830) 279 = *Viscum latifolium* SPRENGEL, see below.

Viscum incanum HOOKER, Ic. pl., t. 73 (1837); ENDLICHER, Gen. pl. (1836—40) 801; WALPERS, Repert., 2 (1843) 438; F. v. MUELLER, Fragm., 2 (1860) 109; OLIVER, in Journ. Linn. Soc., bot., 7 (1864) 104 = **Notothixos incanus** (HOOKER) OLIVER.

Viscum Kaempferi A. P. DE CANDOLLE, Prodr., 4 (1830) 285; G. DON, Gen. Hist. Dichl. Pl., 3 (1834) 408; FRANCHET & SAVATIER, Enum. pl. jap., 1 (1875) 406 = **Taxillus Kaempferi** (A. P. DE CANDOLLE) DANSER.

Viscum latifolium (non LAMARCK 1789, nec SWARTZ 1797) D. DON, Prodr., fl. nepal. (1825) 142 = *Viscum platyphyllum* SPRENGEL, Syst. veg., cur. post. (1827) 47; A. P. DE CANDOLLE, Prodr., 4 (1830) 279 = *Viscum heteranthum* A. P. DE CANDOLLE, Prodr., 4 (1830) 279 = *Henslowia heterantha* ALPH. DE CANDOLLE, in D. C., Prodr., XIV, 2 (1857) 632 = **Hylomyza platyphylla** (SPRENGEL) DANSER (Santalacea).

Viscum platyphyllum SPRENGEL, Syst. veg., cur. post (1827) 47 = *Viscum latifolium*, see above.

Viscum pycnanthum DOMIN, Beitr. Fl. Austr., I, 3, in Bibl. bot., 22 (1921) 604.

I have seen no specimens, but from the description this seems to be rather a *Korthalsella* than a *Viscum*. Perhaps it is the same plant as *Korthalsella Brassiana* BLAKELY, in Proc. Roy. Soc. Queensl., 47 (1936) 79; cfr. Bull. Jard. Bot. Buitenzorg, sér. 3, XVI, 3 (1940).

Viscum spathulifolium THWAITES, Enum. pl. Zeylan. (1864) 418; OLIVER, in Journ. Linn. Soc., bot., 7 (1864) 92, 103; BENTHAM & HOOKER FIL., Gen. pl., III, 1 (1880) 215 = **Ginalloa spathulifolia** (THWAITES) KURZ.

Viscum subaureum F. v. MUELLER, ex OLIVER, in Journ. Linn. Soc., bot., 7 (1864) 92 = **Notothixos subaureus** OLIVER, ibidem.

Viscum verticilliflorum ROYLE, Ill. Himal. Bot., 1 (1839) 235, nomen.

This is enumerated, with other *Visca*, as follows: "and *Viscum verticilliflorum* nob., nearly allied to *V. Wightianum*, WALL. at Mussooree on the oak." The leafy species perhaps meant here and occurring near Mussooree on oak are: *V. album*, and perhaps *V. monoicum*; the leafless ones are: *V. nepalense*, *V. liquidambaricolum*, and *Korthalsella opuntia*. The comparison with *V. Wightianum* does not help us in interpreting ROYLE's plant.

Viscum Wallichianum WIGHT & ARNOTT, Prodr. Fl. Pen. Ind. Or. (1834) 379; WALPERS, Repert., 2 (1843) 437; HOOKER FIL., Fl. Br. Ind., V, 13 (1886) 227.

This species is based on WIGHT Cat. no. 1221. In the Kew Herbarium there is a specimen under this name numbered "1221" and "Herb. WIGHT No. 57". This certainly is a *Loranthacea*, but no *Viscum*. According to a note by GAMBLE on the sheet, this botanist supposed

the specimen to be *Helicanthes elastica* (DESROUSSEAUX) DANSER ("May this not be a *Loranthus* near *elasticus*, DESR.?").

Viscum Wightianum WIGHT & ARNOTT, Prodr. Fl. Pen. Ind. Or. (1834) 380; WALPERS, Repert., 2 (1843) 437; HOOKER FIL., Fl. Br. Ind., V, 13 (1886) 227.

This species is based on WIGHT Catal. no. 1222 = WALLICH, Cat. no. 6877 partly. I found, in the Kew Herbarium, under this name, a specimen numbered Herb. WIGHT 56. This is certainly a *Loranthacea*, but no *Viscum*, and probably, as GAMBLE remarks, on the sheet, *Helicanthes elastica* (DESROUSSEAUX) DANSER. ["May not this be *Loranthus Euphorbiae*, WT.? (*L. elasticus*, DESR.)"].

List of collectors' numbers

referring to the species by means of their number.
(β = var., app. = dubia et excludenda).

ADAM, Sir F., s. n. = 17, 18.
AITCHISON 48 = 5; 87 = 1.
ANGLADE 2151 = 18.
ARNOLD ARBORETUM 72651 = 13.
AUCHER-ELOY 4642 = 1; 4643 = 1.
BARBER 1205 = 17; 1607 = 8; 1609 = 17; 2785 = 11; 2786 = 17; 6821 = 8; 7400 = 10; 8547 = 11; 8548 = 10; 8549 = 17; 8552 = 22; 8648 = 17; 10376 = 8; 10531 = 10; 12609 = 17; 13339 = 18.
BARRETT 75 = 1.
BEDDOME s. n. = 18.
BHATTACHARYAY 11 = 19.
BOISSIER s. n. = 5.
BOR 2992 = 8; 2993 = 8; 7512 = 8.
BORNMÜLLER 1414 = 5.
BOURNE s. n. = 10, 17; 191 = 10; 864 = 8; 1767 = 18 β; 1768 = 10; 2423 = 10; 2875 = 17; 5076 = 17.
BRASS 1933 = 7; 2519 = 7.
BRILLET s. n. = 1 β.
BUSHELL s. n. = 1.
CANTON CHRISTIAN COLLEGE 7970 = 9; 9265 = 13; 9560 = 20.
CARLES 855 = 9.
CAVALERIE 3134 = 9?; 4201 = 20; 4258 = 9; 7323 = 9?; 7496 = 9?.
CHAMPION s. n. = 18; 402 = 13.
CHANET 1001 = 1.
CHATTARJEE 16 = 17.
CHING 1044 = 1; 2182 = 9.
CHRISTY s. n. = 5.
CHUN, W. Y., 7871 = 9.
CHUN & TSO 43963 = 13.
CHUNG 3799 = 9.
CLARKE s. n. = 19; 11254 = 10, 8; 11266 = 8; 17290 = 19; 19286 = 7; 20806 = 19; 21652 = 17; 27572 = 8; 31186 = 1.
COLLETT s. n. = 1, 9; 15 = 15; 718 = 8.
COPELAND 618117 = 12.
CORNER 28992 = 14.
CRAIB 341 = 8.
CUMING 1960 = 12; 2258 = 7.

Dalhousie s. n. = 1.
Dalziel s. n. = 9, 9?.
Das 138 = 8.
David 1706 = 1.
Davidson s. n. = 9.
De 17461 = 1β.
Deane s. n. = 1.
De Voogd 2823 = 7.
Dietrich, Amalia, s. n. = 7, 23, 24; 374 = 7.
Dinsmore 8162 = 5.
Drummond 15081 = 12; 21492 = 1; 21985 = 1; 23862 = 1.
Ducloux 364 = 9; 606 = 8.
Duthie s. n. = 1; 134 = 5; 5944 = 9; 9727 = 8; 10549 = 8; 13012 = 1.
Edgeworth 195 = 1; 4004 = 8; 4006 = 19.
Elmer 17777 = 12.
Falconer s. n. = 1.
Farges s. n. = 3, 9, 9?.
Faurie 1253 = 1; 1254 = 1; 6809 = 1.
Fielding s. n. = 1.
Fischer, C. E. C., 324 = 10; 329 = 21; 1923 = 17; 2079 = 8.
Forbes, F. B., s. n. = 1.
Forrest 542 = 9?; 10174 = 9; 11112 = 9; 12719 = 9; 13811 = 9; 16142 = 9; 18155 = 9; 25388 = 1β.
Freyn 1414 = 1.
Friedland s. n. = 17.
Fuller s. n. = 1.
Gamble s. n. = 18; 370 = 8; 698 = 8; 711 = 1β; 1143 = 8; 2979 = 8; 4393 = 1; 6233 = 9; 6269 = 1; 6640 = 19; 6668 = 19; 8711 = 19; 8810 = 8; 9106 = 17; 9210 = 8; 10232 = 8; 11693 = 11; 12114 = 18; 12115 = 11; 12380 = 17, 18; 13837 = 17; 14508 = 10; 15436 = 10; 15693 = 21; 15866 = 17; 16012 = 19; 16115 = 18; 17242 = 10; 20669 = 18; 21206 = 17; 24174 = 1; 25663 = 8; 26736 = 1; 26768 = 1.
Gammie 18220 = 1.
Gardner 831 = 18.
Gatacre 17526 = 1; 17527 = 5.
Gaudichaud s. n. = 13.
Griffith s. n. = 8, 17; 601 = 19; 1372 = 1; 2079 = 9; 2736 = 1; 2738 = 17; 2742 = 7; 2743 = 7; 2744 = 8.
Haines 349 = 17; 2373 = 19; 3500 = 17; 5234 = 19; 5235 = 17.
Hance 1451 = 9.
Hancock 37 = 13; 362 = 8.
Handel-Mazzetti 4414 = 12.
Hare s. n. = 1, 5.
Harsukh 15549 = 1.
Hayne s. n. = 1, 5.
Hearsey s. n. = 8.
Heinig s. n. = 19.
Heinig & Gammie 15 = 19?.
Henry, A., 59 = 9; 3206 = 9?; 7883 = 1; 8420 = 13; 9942 = 9; 10303, 10303A = 9; 12758 = 20.
Henry, B. C. 18 = 9?.
Hervey s. n. = 7.
Heyne s. n. = 8, 17.
Hohenacker 1478 = 10; 1480 = 18.
Holtermann s. n. = 17, 18, 19.
Holttum 9801 = 7.
Hooker s. n. = 8, 9, 17, 19.
Hooker & Hanbury s. n. = 5.
Hooker & Thomson s. n. = 7, 19; 1226 = 8.
Hornemann s. n. = 8.
Hu, H. H., 146 = 9; 243 = 9?; 916 = 9?; 1110 = 1; 1172 = 9?.
Hubbard 2899 = 7.
Huk, Abdul, 171 = 7.
Inagaki s. n. = 1.
Inayat 20934 = 5; 23818 = 8; 23819 = 19; 26008 = 12.
Jacobson 19B, 2044, 2162 = 12.
Jacquemont 634 = 10; 667 = 1; 1283 = 10.
James s. n. = 1.
Jamesen s. n. = 1.
Johnson s. n. = 7.
Johnston 73 = 5.
Kanjilal 1038 = 8; 1057 = 1; 1099

STUART s. n. = 1.
SWINHOE s. n. = 9.
TAKEDA s. n. = 1.
TALBOT s. n. = 10, 21; 16 = 8; 780 = 19; 1142 = 8; 3573 = 17.
TENGWALL 523 = 1.
THOMSON s. n. = 1, 1β, 8, 10, 17, 18, 19; 1058 = 1.
THWAITES C. P. 412 = 17, 18; 479 = 8; 481 = 18?; 1637 = 8; 1638 = 22; 1639 = 18.
TSANG WAI-TAK 54 = 13; 91 = 9?; 431 = 13; 662 = 13; 18319 = 9?.
TSANG FUNG TANG 17593 = 9.
TSANG & FUNG 18073 = 20.
TSCHONOSKI s. n. = 1.
TUTCHER 2208 = 13.
URTI DUTT 8101 = 8.
VICARY s. n. = 8, 17, 19.
WALKER s. n. = 7, 18.
WALLICH s. n. = 9, 19; 489 = 13; 490 = 1; 491 = 17, 18; 492 = 19; 494 = 13; 495 = 8; 496 = 8; 497 = 10; 498 = 7; 6875 = 18; 6876 = 11; 6877 = app.; 6878 = 22; 6879 = app.
WANG, C. T., 541 = 9.
WANG, Y. K., 520 = 20.
WALSH 20 = 7.
WARD, F. KINGDON, 6359 = 8; 8059 = 8.
WATT 6164 = 9.
WIGHT s. n. = 8, 17, 22; 45 = 18; 46 = 17; 47 = 18; 48 = 8; 51 = 18; 52 = 10; 53 = 11; 54 = 22; 55 = app.; 56 = app.; 57 = app.; 1219 = 17; 1221 = app.; 1222 = app.; 1223 = 22; 1224 = 22; 1225 = 11; 1226 = app.; 1228 = 8; 1244 = 11; 1246 = 10; 1248 = 8; 1249 = 17; 1250 = 18; 1252 = 22; 1253 = 18.
WILFORD 286 = 13.
WILSON, E. H., s. n. = 1; 3262 = 9?; 3263 = 9?; 4482 = 9?; 4483 = 4; 7765 = 1; 7766 = 1; 8583 = 1; 8709 = 1; 9289 = 1; 9576 = 1; 9581 = 1; 9713 = 2; 9834 = 9; 10024 = 9; 10032 = 9; 10109 = 20; 10522 = 1.
WOOD s. n. = 8, 17, 19.
WRAY 2023 = 7.
WRIGHT 181 = 13; 182 = 13.
YAPP 393 = 7.

Index to the names of Viscum species and varieties.

(Accepted names in heavy types, new names indicated by an asterisk).

Plate I. Type of *Viscum Acaciae* DANSER (ROBERTSON 1823) in the Dehra Dun Herbarium. (Photo L. ALKEMA.)

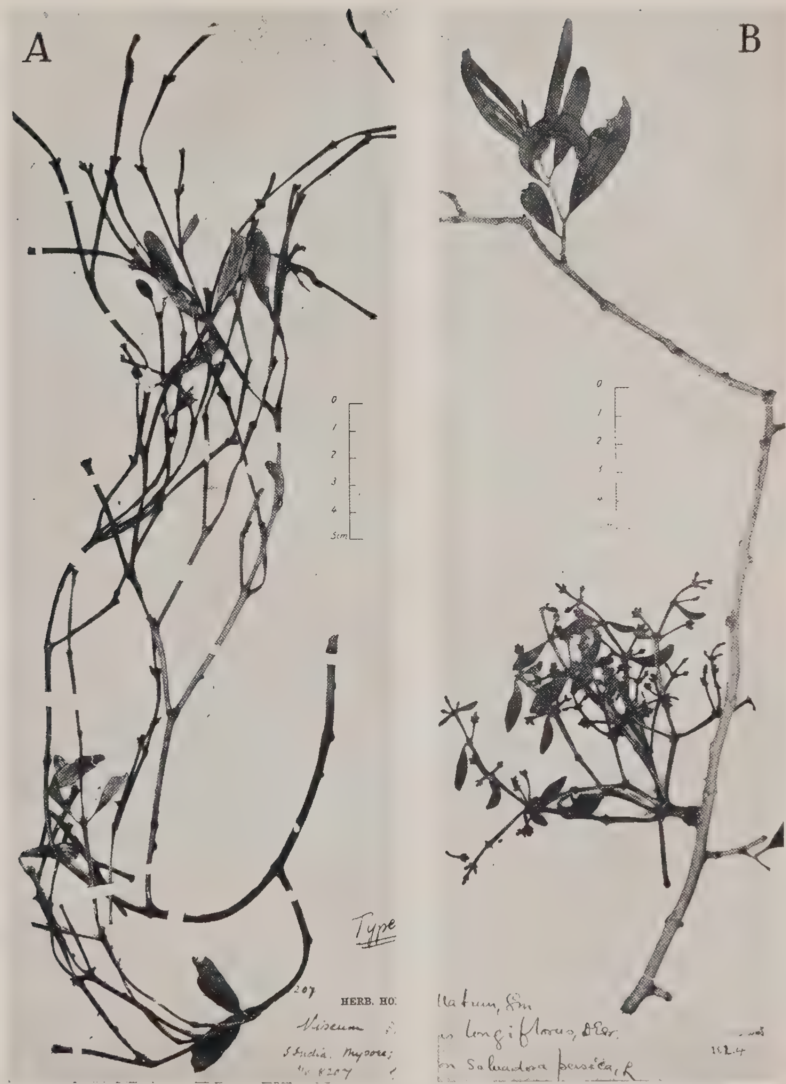


Plate II. A: Type of *Viscum mysorense* GAMBLE (MEEBOLD 8207) in the Kew Herbarium. B: Rather young, flowering specimen of *Viscum capitellatum* SMITH (BARBER 8552), on *Dendrophthoë falcata,* in the Kew Herbarium (Photo L. ALKEMA.)

Plate III. A: Type of *Viscum trilobatum* TALBOT (TALBOT s. n.) in the Dehra Dun Herbarium. B: Twig of *Viscum trilobatum* TALBOT with more normal leaf shape (GAMBLE 15693) in the Kew Herbarium. (Photo L. ALKEMA.)

THE DISTRIBUTION OF KORTHALSELLA DACRYDII

by

J. WASSCHER

(Botanical Laboratory of the University, Groningen, Netherlands).

Korthalsella Dacrydii (RIDLEY) DANSER, the only species of its genus that is parasitic on Conifers, was, up to the present, only known from two mountains, *viz.*, Mt. Tahan in the Malay Peninsula, and Mt. Gedé in Java. For the latter mountain it was, for the first time, not discovered in the living state, but, by Dr VAN STEENIS, on herbarium specimens of *Podocarpus imbricata*, collected by KOORDERS and

VAN DER HOEVEN in 1890. Later it was collected several times on Mt. Gedé in the living state.

While examining the materials of *Podocarpus* and *Dacrydium* of the Leiden, Buitenzorg, and Groningen Herbaria, I was so fortunate as to discover, in the same way as Dr VAN STEENIS did, several new localities of *Korthalsella Dacrydii*, and these not only in Java, but also in Sumatra, Borneo, and Timor. The localities now known are the following.

MALAY PENINSULA. Pahang, Mt. Tahan [see DANSER, in Bull. Jard. Bot. Buitenzorg, sér. 3, XIV, 2 (1937) 126, 3 collections].

SUMATRA. Atjeh, subdiv. Tamiang, Tenggoeloen, at 950 m, 30 XI 1926, on BOSCHPROEFSTATION B.B. 10748 (B); East-Coast, eastern foot of Mt. Siboeatan, near Pantjarbatoe, at 1400 m alt., 27 I 1920, on LÖRZING 7117 (B).

BORNEO. S.E. part (prob. Mt. Sakoembang), on KORTHALS s.n. (G).

JAVA. Without exact locality, on BLUME s.n. (L); Mt. Gedé, above Tjibodas and along the path to Tjibeureum (see DANSER, l.c., 5 collections); Tjibodas, 20 X 1896, on KOORDERS 25922 β (tree no. 3276a) (B, L); 26 VII 1913, on KOORDERS 41972 β (tree no. 3342a) (B); 1925, on SAPEI 147 (B); at 1500 m alt., 7 IX 1923, on SAPIIN s.n. (tree no. 3417a) (B); Geger Bintang, at 1500 m alt., 26 IX 1918, on DEN BERGER 549 (B); Bandoeng, on JUNGHUHN s.n. (L); Mt. Telagabodas, near Pangentjongan, 22 VIII 1893, on KOORDERS 14159 β (B); Mt. Oengaran, 10 X 1888, on KOORDERS 1283 β (tree no. 2380i) (B); Mt. Wilis, Ngebel, 17 X 1892, on KOORDERS 1280 β (tree no. 2126f) (L); Mt. Kawi, near Poedjon, 6 III 1923, on BURGER 6336 (B).

TIMOR. South Central Timor, near Nenas, at 1600 m alt., 26 VIII 1927, on BOSCHPROEFSTATION B.B. 11803 (B).

Whereas the plants from Mt. Tahan and Atjeh were parasitic on *Dacrydium*, all the further specimens from Sumatra, Borneo, Java and Timor were inserted on *Podocarpus imbricata*, and especially on the twigs with short subulate leaves, either between the latter, or in the angle between a twig and its ramification.

From the above it is clear, that *Korthalsella Dacrydii* is by no means rare in the western part of the Malay Archipelago, and that it undoubtedly will be discovered in the future in many localities in the mountains of Sumatra, Borneo, Java, and the Lesser Sunda Islands, especially at elevations between 1400 and 1800 m.

SARCOSPERMA IN NEW GUINEA

by

H. J. LAM,
(Rijksherbarium, Leiden).

More than two years ago I published, in collaboration with W. W. VAROSSIEAU, a Revision of the Sarcospermataceae (Blumea 3, no. 1, 1938, 183—200), to which a small map was added, showing the areas of the 6 species known. Four of these have more or less continuous areas on the Continent of Asia, one is only known from a small area on Sumatra's East Coast and one, taxonomically speaking the most isolated species, has a remarkably discontinuous area, the parts of which are widely spread over Malaysia. As was already mentioned in an additional note (Blumea 3, no. 2, 1939, 262), this species, *Sarcosperma paniculatum*, has also been collected in South-Celebes. Recently I came upon a specimen from New Guinea, collected by CLEMENS:

2. **S. paniculata** (KING) STAPF & KING.

New Guinea: N.E. New Guinea, Morobe Dist., Sattelberg, 3300′ alt.: CLEMENS 1292, flow. on 20. 12. 1935.

The small localities in which this species has been found are now known to be scattered over: the Malay Peninsula (Perak), Sumatra (East Coast opposite Perak), Borneo (Mt. Kinabalu), Mindanao (Mt. Apo), South-Celebes, Flores, Ternate, N.E. New Guinea (Sattelberg). The New Guinea specimen shows medium-sized inflorescences.

I take this opportunity to quote some more specimens, examined by me in the collections of the British Museum, Natural History, during a short visit in May 1938:

3. **S. arboreum** HOOK. f.

INDIA, Assam, Garo Hills, Tura, 4000′ alt.: C. B. CLARKE 43080 B, flow. on 14. 2. 1886; Khasia, Nongpriang, 1000′ alt.: ID. 15022, buds on 21. 11. 1871.

6. **S. Griffithii** HOOK. f.

INDIA, Assam, Khasia, Mausmai, 3500′ alt.: C. B. CLARKE 43719 B, fr. on 9. 5. 1886; ibid., sine loc.: KING's Coll. sine num.

NOTE ON THE SAPOTACEAE-MIMUSOPOIDEAE IN GENERAL AND ON THE FAR-EASTERN MANILKARA-ALLIES IN PARTICULAR

by

H. J. LAM

With the collaboration of B. J. D. MEEUSE and R. A. MAAS GEESTERANUS

(Rijksherbarium, Leiden)

(Issued February 8th, 1941).

MANILKARA ADANSON

Manilkara ADANSON, Fam. II, 1763, 166; PIERRE & URBAN, Symb. Antill. **5**[1], 1904, 162 (as a subgenus); DUBARD, Ann. Mus. Col. Mars. 23, 1915, 6; LECOMTE, Bull. du Muséum, 1917, 35 and in Notul. Syst. 3, 1918, 340; BRITTON & WILSON, Scient. Surv. Porto Rico & Virg. Isl. VI, 1, 1925, 72; H. J. LAM, Bull. Jard. Bot. Buitenz., Sér. III, **7**, 1925, 238 and **8**, 1927, 481; BENOIST, Arch. Bot. **5**, Mém. 1, 1931, 241; HUTCHINSON & DALZIEL, Fl. W. Trop. Afr. II, 1, 1931, 14; CHEVALIER, Rev. Bot. appl. & Agric. tropic. 12, 1932, 261, 350; STANDLEY, Trop. Woods 31, 1932, 45; LEMEE, Dictionn. Pl. Phanér. IV, 1932, 291; EYMA, Rec. Trav. Bot. néerl. **33**, 1936, 205 — *Manyl-kara* RHEEDE, Hort. Mal. IV, 1673, 53, t. 25 — *Mimusops* L., sect. *Ternaria* DC., Prodr. **8**, 1844, 203; as a subgenus in ENGLER, Monogr. Afr. Pfl. fam. und Gatt. **8**, Sap., 1904, 55 — *Delastrea* A. DC. in DC., Prodr. VIII, 1844, 195 — *Labramia* A. DC., l. c. 672 — *Mimusops* L., sect. *Euternaria* ENGL., l. c. p.p. (except § *Muriea*) — *Northia* (not of HOOK. f.) sensu H. J. LAM, l. c. 1925, 241 and 1927, 481, pro parte; H. J. LAM, Bern. P. Bish. Mus. Bull. 141, 1936, 163.

Trees with hard and often reddish wood and sympodial branchlets; stipules caducous or none; leaves more or less coriaceous, often obovate with rounded apex, lower side often lighter coloured than upper one, with sclereids (f. LECOMTE); tertiary nerves very slender and numerous, in general parallel to the secondary ones which are hardly more conspicuous, often with a minute reticulation between; inflorescences axillary, fasciculate; sepals in two rows of 3 each; petals 6, with narrowed base inserted on a corolla-tube as long as or shorter than the petals, each of them with two dorsal appendages which are mostly about as long as

the petals and of the same shape but often narrower and more acute, rarely much shorter (about ½ or less in *M. kanosiensis* and *M. vitiensis*); stamens 6, epipetalous; staminodes 6 alternipetalous and in the same row as the stamens, differently shaped, broadly ovate, acuminate to small or subulate, irregularly dentate or fimbriate, trifid or bifid, sometimes scalelike, very rarely reduced to none (*M. fasciculata, vitiensis*); ovary 15—6-celled, pubescent, but sometimes surrounded by a glabrous adnate disc; cells 1-ovuled, ovules ventrally or basiventrally attached; fruit drupaceous, but pericarp often rather dry, 6—1-seeded; scar of the seed ventral or basiventral, long and narrow or rarely larger and ovate (*fasciculata*) or circular (*M. Bojeri, dissecta, Eickii*); albumen abundant, the cotyledons thin. About 74 species in all tropical countries, of which about 25 in Central America, about 34 in the African region and some 15 in Asia-Polynesia.

Key to the Far-Eastern species (cf. *Table II*, p. 353).

1 a. Leaves minutely tomentose or sericeous and therefore pale underneath . 2
b. Leaves entirely glabrous, the two surfaces of the same colour, though sometimes of different shades 5
2 a. Leaves small, 2½—7½ by 1½—3½ cm, densely crowded at the tips of the branchlets, with narrow base, petioles 1—2 cm long; fruit not longer than 1 cm, scar on the seed circular. *Pacific Isl.* . . . . **1. M. dissecta**, var. *β* **Pancheri**
b. Leaves larger, 5—13 by 3½—8½ cm, petioles 1½—5½ cm . . . 3
3 a. Leaves elliptic-ovate to somewhat obovate, little broader in the upper half than in the lower, base broadly acute to subrotundate; flowers 0.9—1.0 cm long, the pistillum 1.5 cm with the style well exsert; petals 0.9 cm long, tube 0.3 cm; ovary 9—7-celled. *Fiji* . . . . **2. M. Smithiana**
b. Leaves mostly distinctly obovate with narrow base and broad upper half . 4
4 a. Leaf-base acute to rotundate, basal angle 75°—180°; nerves ascending at an angle of 60°—70°; flower buds ovoid, 0.6—0.7 cm long, the pedicels not gradually incrassate at top; appendages as long as petals, staminodes 0.35—0.5 × 0.15—0.3 cm; ovary with distinct glabrous annular disc at base, 7—6-celled. *S. E. Asia—Australia* . . . . **3. M. Kauki**
b. Leaf-base always acute, basal angle 80°—90°; nerves ascending at an angle of 45°—50°; flower buds club-shaped, borne upon gradually incrassate pedicels and about 1 cm long; appendages about ²/₃ as long as petals; staminodes 0.25—0.4 × 0.1—0.15 cm; ovary without disc, 6-celled. *C. and N. Celebes* . . . . **4. M. celebica**
5 a. Flowers small, calyx 0.4—0.7 cm long 6
b. Flowers larger, calyx 0.8—1.4 cm long 10
6 a. Secondary nerves, though faint, distinguishable from the tertiary ones and at the margin archingly joined 7
b. Nervation striate, all nerves about as faint, close to the margin united to form a distinct intramarginal nerve 8

7 a. Leaves 2½—7½ by 1½—3½ cm, obovate with narrow base; pedicels 1½—2, in fruit 2½—3 cm; ovary 6-celled, with glabrous disc; fruit not longer than 1 cm; scar on the seed small and circular. *W. Pacific Isl.* . . . . **1. M. dissecta**, var. α **typica**

b. Leaves 3½—11 by 2½—6½ cm, oblong or ellipsoid to slightly obovate with broad base; pedicels 0.8—0.9 cm long; ovary 12—9(—6)-celled, with glabrous disc; fruit 1—1½ cm long; scar on the seed oblong. *Continental Asia* . . . . **5. M. hexandra**

8 a. Leaves obovate with narrow base, nerves ascending at an angle of 60°—70°; appendages about as long and broad as the petals; staminodes broad and dentate or denticulate; fruit about 1½ by 1 cm, scar on the seed oblong. *Caroline Isl.* . . . . **6. M. udoido**

b. Leaves oblong or elliptic or slightly obovate, base not conspicuously narrower; nerves ascending at an angle of 70°—80° 9

9 a. Staminodes ovate or ovate-oblong, the apex with some teeth; appendages probably about $^2/_3$ of the length of the petals, lanceolate-oblong. *Philippines, C. Celebes, N. Moluccas* . . . . **7. M. Merrilliana**

b. Staminodes filiform, sometimes wanting; appendages subulate, about ¾ as long as the petals. *New Guinea* . . . . **8. M. fasciculata**

10 a. Leaves obovate, the base rounded or slightly subcordate, the apex broad and usually emarginate, petioles 1.2—1.8 cm, pedicels 2.5—3.5 cm long; appendages as long as the petals, about 0.7 cm. *India* . **9. M. Roxburghiana**

b. Leaves elliptic or oblong to oblong-obovate, the base acute or subrotundate, the apex subrotundate or obtuse, sometimes somewhat emarginate; pedicels 1.5—2.5 cm long; appendages $^1/_5$—$^2/_3$ as long as the petals 11

11 a. Leaves 5—9 by 3½—5 cm, apex rotundate and often slightly smarginate; petioles 1—2½ cm long; calyx 1 cm, petals 0.65 cm long; ovary with glabrous disc. *Papua* . . . . **10. M. kanosiensis**

b. Leaves 7½—13 by 3—5 cm, apex obtuse; petioles 2—5½ cm long; flower-buds oblong and acute; calyx 1.1—1.4 cm, petals 1.0—1.3 cm long; ovary without disc. 12

12 a. Secondary nerves ascending at an angle of about 85°, tertiary nerves about 3 between each pair of secondary ones; pedicels incrassate towards the top, the bud about 1½ by 1 cm; petals 1.1—1.3, the appendages 0.75 cm long, staminodes 0.3—0.6 by 0.2—0.3 cm; ovary 9-celled. *Samoa.* . . . . **11. M. samoensis**

b. Secondary nerves ascending at an angle of about 70°, tertiary nerves mostly one between each pair of secondary ones; pedicels less incrassate towards the bud, which measures about 1 by 0.3—0.4 cm; petals 1—1.2, the appendages 0.25 cm long, staminodes, if any, 0.2 by 0.2 cm; ovary 6-celled. *Fiji* . . . . **12. M. vitiensis**

Incompletely known:
13. M. emarginata (Hawaii), **14. M. Kurziana** (Burma), **15. M. littoralis** (Farther India).

1. **M. dissecta** (L. F.) DUBARD, Ann. Mus. Col. Mars. **23**, 1915, 13; GUILLAUMIN, Journ. Arn. Arb. 13, 1932, 15 — *Achras dissecta* L. F. (not of FORST.), Suppl. 1781, 210 — *Mimusops dissecta* R. BR. (not of

BUCH.-HAM.), Prodr. 1810, 204 and 531 (in obs.); HEMSLEY, Journ. Linn. Soc. Bot. 30, 1895, 183 (sub *Mimusops Kauki*) — *Mimusops Pancheri* BAILL., Bull. Mens. Soc. Linn. Par. 114, 1891, 907 — *Manilkara Pancheri* (BAILL.) DUB., l. c. 1915, 12 — *Fig. 1.*

A moderate-sized tree with heavy gnarled trunk and dense foliage. Young branchlets terete, 0.2—0.4 cm thick, older ones densely scarred and 0.5—0.6 cm thick. *Leaves* estipulate, densely crowded at the tips of the branchlets, coriaceous and bright green with a semitransparent edge when alive, very rigid and brittle when dry and very dark brown or brown on both sides (var. α) or with a pale underside (var. β), glabrous from the beginning (var. α) or with a more or less persistent pale indumentum at the lower surface and more or less glabrescent afterwards (var. β), obovate with cuneate base and rounded or rarely subacute, often slightly emarginate apex, 2.5—7.7 by 1.5—3.8 cm, petioles 0.8—1.8 cm, slender, sulcate above. Midrib somewhat depressed above, prominent below; secondary nerves hardly conspicuous, 8—12, ascending at an angle of about 65°, straight or nearly so, not very close to the margin faintly archingly joined; tertiary nerves consisting of a more or less longitudinally stretched reticulation parallel to the secondary ones, extending even beyond the marginal archs. *Flowers* axillary, densely crowded between the leaves, 1—3 in an axil, the pedicels curved downwards, more or less tomentose to almost glabrous, in flower 1.7—2.1 (var. α)—2.7 (var. β) cm, in fruit 2.5—2.8 (var. α)—3.7 (var. β) cm long, slightly incrassate below the ovoid obtuse bud and particularly below the fruit; flowerbuds about 0.5 cm long. *Sepals* 3 + 3, greyish or pale-brown tomentose without, glabrous within, the outer ones obtusely triangular and about 0.5—0.65 by 0.25—0.35 cm, inner ones ovate or ovate-oblong and 0.5—0.7 by 0.2—0.4 cm. *Corolla* glabrous, the tube about 0.1 cm long, the 6 petals oblong and obtuse, 0.45—0.55 by 0.1—0.15 cm, appendages narrower and subulate, little shorter than the petals, 0.25—0.45 by 0.06—0.15 cm. *Stamens* 6, the filaments terete, broader at base and 0.2—0.3 cm long, anthers acuminate and versatile, 0.2—0.3 cm long; *staminodes* ovate-acuminate with irregularly undulate or dentate margin, 0.1—0.2 by 0.06—0.1 cm. *Ovary* semiglobose to subconical, 6-angulate and 6-celled, pubescent, with a shallow glabrous adnate disc at the base, contracted into a glabrous truncate style of about 0.6—0.8 cm long; ovules basiventrally attached. *Fruit* 1-seeded, pulverulent but glabrescent, the sepals reflexed, ovoid to subglobular and 0.6—1 by 0.5—0.7 cm (var. α) or oblong and 0.9—1 by 0.45—0.5 (var. β), pericarp apparently dry and very thin,

crowned by the style at the apex. *Seed* with a very thin testa (0.015 cm thick), oval and 0.6—0.75 × 0.5 × 0.35—0.4 cm or more oblong and 0.9 × 0.4 × 0.4 cm, sometimes with 3 more or less pronounced ribs on the ventral side, scar basiventral to almost basal, elliptic, 0.3—0.35 by 0.2—0.22 cm; albumen abundant, surrounding the thin cotyledons and the short and blunt but not exsert radicle.

Var. α **typica** MAAS GEESTERANUS, nov. var. (*Achras dissecta*, l. c.) — Folia ab initio glabra, i. s. saepe fusca. Pedicelli florigeri subglabri 1.7—2.1 cm, fructigeri 2.5—2.8 cm longi. Fructus ovoidei vel subglobosi, 0.6—1 × 0.5—0.7 cm.

SAMOA: T. POWELL 187 (several sheets in Herb. Kew, fr. in Jun. 1877, flow. in Aug. 1878; nat. name: *"pani"* or *"o le pani"*. Annotations by Rev. POWELL: "The trunk of this tree is gnarled, twisted and knotted, and grows "to a very large size 20—30 ft in circumference. It gives off very numerous "aerial roots which hang down and then grow into and unite with any part of "the trunk below with which they come in contact, and this to a great extent "is the cause of the gnarled knotted appearance: at about 6—8 ft up it gives "off large, sub-erect branches: it attains a height of only 20—30 ft. — A sticky "gum exudes from the bark when wounded and also spontaneously from the "young branches. The bark also yields a bright reddish-brown dye which the "natives use to tinge their hair and paint their siapo — Jan. 13th 1877."

TONGA — s. loc.: FORSTER s. n. (*type specimen* in Herb. Kew and Herb. Berl., flow.); Tonga Tabu: U. S. Explor. Exp. under Capt. WILKES (in Herb. Kew, y. fr.).

Remarks: During an earlier part of this investigation we disposed of another specimen, attributed with some doubt to var. α, viz.:

NEW CALEDONIA — Isle of Pines: PELLETIER 39 (nat. name: *bugni* [french pronunciation]). This specimen is, however, no longer available, so that it could eventually not be checked. It was sterile and — possibly consequently — the leaves are exceptionally large, viz. up to 13.2 × 5.9 cm. The specimen, if correctly identified, is of special interest since both varieties should then be found in New Caledonia.

Var. β **Pancheri** (BAILL.) MAAS GEESTERANUS (*Mim. Pancheri*, l. c.) — Folia subtus cum petiolis innovationibusque tomentosa, adulta subglabrescentia, i. s. saepe brunnea. Pedicelli florigeri pubescentes, 2.2—2.7, fructigeri 2.7—3.7 cm longi. Fructus oblongi, 0.9—1 × 0.45—0.5 cm.

NEW CALEDONIA — s. loc.: PANCHER s. n. (*type specimen* in Herb. Par.); Isle of Pines, Observatory: ? COLL. (? MILNE) 430 (Herb. Hookerianum in Herb. Kew; sea shore shrub, flow. in Dec. 1853); Ile des Pines: M. GERMAIN s. n., A° 1874—1876, reçu du R(év.) P(ère) GOUJON, in Herb. Par.; flow. and fr.; nat. name: *bunyi*) — Lifu: BALANSA 1821 (Herb. Par., fr.); between Tio and Nékété: ID. 3470 (Herb. Par., fr.).

Distribution: Samoa, Tonga, New Caledonia, New Hebrides (Aneityum, f. GUILLAUMIN, l. c.).

2. M. Smithiana H. J. LAM & MAAS GEESTERANUS, nov. spec. — *Fig. 2* — Arbor parva. Ramuli grisei, 0.4—0.7 cm crassi. *Folia* coriacea, estipulata ad ramulorum apices laxe conferta, e petiolis 2.5—4.5 cm longis sericeis supra sulcatis elliptico-ovata vel paulo obovata, basi late acuta ad subrotundata, apice rotundata, interdum brevissime obtuse acuminata, 7—11 cm longa, 3.5—6 cm lata, supra i. s. olivacea et glabra, subtus grisei-sericea. Costa supra sulcata, subtus prominens; nervi secundarii, paulo curvati, supra haud, subtus vix conspicui, 15—20, angulo 70°—75° adscendentes, prope marginem nervo intramarginali paulo arcuato juncti; nervi tertiarii 1(—3) gracillimi inter secundarios, reticulatione vix conspicua supra minutissime bullata. *Flores* in superiorum foliorum axillis solitarii vel bini; pedicelli recurvi cum sepalis griseo-ferrugineo-tomentosi, 1.5—2.2 cm longi, apice sensim incrassati. *Sepala* 3 + 3, intus subglabra, acuta, exteriora oblongo-lanceolata, 0.85—0.9 × 0.3—0.35 cm, interiora lanceolata, 0.95—1.0 × 0.25—0.3 cm. *Corolla* glabra, tubo 0.3 cm longo, petala 6 oblonga, obtusa, 0.9 × 0.25 cm, appendicibus lanceolatis acutis, 0.65—0.7 × 0.25 cm. *Stamina* 6, filamentis 0.5 antheris 0.4 cm longis; *staminodia* oblongo-ovata apice irregulariter dentata, 0.4—0.45 × 0.25 cm. *Ovarium* 7—9-loculatum, semiglobosum, pubescens, basi disco angusto glabro adnato cinctum, 0.25 cm altum, in stylum glabrum, 1.25 cm longum contractum; ovula hemi-anatropa loculi medio ventraliter affixa. *Fructus* ignotus.

A small tree. Branchlets greyish, 0.4—0.7 cm thick. *Leaves* estipulate, laxely conferted at the tips of the branchlets, coriaceous, glabrous and when dry olivaceous above, greyish sericeous below, elliptic-ovate or somewhat obovate, base broadly acute to subrotundate, apex rotundate, sometimes minutely bluntly acuminate, 7—11 × 3.5—6 cm, petioles 2.5—4.5 cm long, canaliculate above, greyish tomentose. Midrib sulcate above, prominent below; secondary nerves very faint, arising at an angle of 70°—75°, somewhat conspicuous below, 15—20, gently curved, near the margin flatly archingly joined into an intramarginal nerve; tertiary nerves 1(—3) between each pair of secondary ones still fainter, reticulation hardly conspicuous, very minutely bullate above. *Flowers* 1 or 2 in the uppermost leaf-axils, pedicels greyish-ferruginously tomentose as are the sepals, incrassate at apex, 1.5—2.2 cm long. *Sepals* 3 + 3, acute, subglabrous within, the outer ones oblong-lanceolate, 0.85—0.9 × 0.3—0.35 cm, the inner ones lanceolate and 0.95—1 × 0.25—0.3 cm. *Corolla* glabrous, tube 0.3 cm long, petals 6, oblong, obtuse, 0.9 × 0.25 cm, the appendages lanceolate, 0.65—0.7 × 0.25 cm. *Stamens* 6, the filaments filiform and 0.5 cm long,

anthers acute 0.4 cm; *staminodes* oblong-ovate with irregularly dentate apex, 0.4—0.45 × 0.25 cm. *Ovary* 9—7-celled, semiglobose, appressedly pubescent but for a shallow glabrous adnate disc at base, contracted into a glabrous subulate style of about 1.25 cm long; ovules ventrally affixed halfway up the cell, hemi-anatropous. *Fruit* unknown.

FIJI — Vanua Mbalavu, Malatta, forest, Southern limestone section, 0—100 m alt.: A. C. SMITH 1450 (*type specimen* in Herb. Bish. Mus. Honol. and Herb. Leiden; flow. March 29, 1934; tree 7 m high, corolla, filaments and staminodes white).

3. **M. Kauki** (L.) DUB., Ann. Mus. Col. Mars. **23**, 1915, 9, fig. 1, 2; H. J. LAM, Bull. Jard. bot. Buitenz. Sér. III, **7**, 1925, 239 and **8**, 1927, 481 — *Mimusops Kauki* L., Sp. Pl. ed. I, 1753, 349 — *Achras dissecta* FORST. F., De Plant. Esc. 1786, 43 — For further references cf. the above-quoted papers — *Fig. 3.*

Trees up to 20 m high, with dense greyish foliage and white latex. Branchlets sympodially composed, terete, 0.25—0.5 cm thick, the older ones verrucose by leafscars. *Leaves* conferted at the tips of the branchlets, glabrous and shiningly dark green above, silvery glossy underneath by a very much appressed indumentum, the older ones dirty greyish, glabrescent and dull, rigid, broadly obovate, the base acute to almost rounded, basal angle 75° to almost 180°, apex sometimes emarginate, mostly rounded to obtuse or somewhat acute, 5—13 by 3.5—8.5 cm, petioles (1.6—)2—4(—5.5) cm, slender; midrib depressed above, prominent below; secondary nerves straight or mostly somewhat curved, faintly conspicuous, 12—18 on either side, angle 60°—70°, diminishing towards the apex, archingly joined near the margin, the tertiary ones still fainter and strictly parallel, with a very minute reticulation between. *Flowers* up to 1 cm long and broad, solitary or 2, rarely 3 together in the leaf-axils, the pedicels curved, 1.3—2.1, in fruit (1.3—) 2—3.3 cm long, appressedly light-brown pubescent as are the sepals. Flower buds ovoid, obtuse, the pedicel not gradually incrassate below the bud. *Sepals* 3 + 3, acute, spreading, often reflexed in the fruit, sparsely pubescent or subglabrous within, the outer ones 0.6—0.75 by 0.35—0.45 cm, the inner ones 0.65—0.7 by 0.3—0.45 cm. *Corolla* light-yellow, glabrous, hardly exsert, the tube 0.15—0.3 cm long, petals lanceolate with subacute apex, 0.45—0.7 by 0.1—0.25 cm, appendages of same shape and dimensions. *Stamens* and staminodes equally long or the staminodes somewhat shorter, but shorter than the petals, filaments 0.2—0.3, the anthers 0.2—0.4 cm long, stout; *staminodes* ovate-acuminate with fimbriate or irregularly dentate margins, often more or less bifid at top, 0.35—0.5 × 0.15—0.3 cm. *Ovary* 8—6-celled, pubes-

cent but surrounded by a glabrous adnate disc, subabruptly narrowed into the filiform and glabrous style, which is 0.8—0.95 cm long and exserted above the corolla. *Fruit* ovoid, reddish or orange-brown, somewhat shining with pretty dry pericarp, 6—1-, mostly 3—2-seeded, 2.5—3.7 × 1.8—3.3 cm. *Seeds* ovate in cross-section or ± flattened, shiningly pale brown, rounded at apex, bluntly acute at base, 1.5—1.8(—2.25) × 0.8—1.2(—1.35) × 0.55—0.8(—1.05) cm, testa about 0.1—0.15 cm thick, crustaceous, the scar narrow, 0.65—1.1 × 0.15—0.25(—0.35) cm, situated in the lower half of the seed.

The following specimens may be cited in addition to those quoted formerly:

COCHIN CHINA, foot of Mt. Diai, prov. Chandoc: PIERRE 3260.

JAVA — s. loc.: DE VRIESE (Herb. Leid. 908.225—332, 333 and 340); VAN ROYEN (H. L. 908.225—321); BLUME (H. L. 908.225—330, 336, 354 and 355); KOORDERS 10142 β, 10143 β; Batavia, Tandjoengpriok: KUHL & VAN HASSELT (H. L. 908.225—322); Batavia, Middelburg Isl.: HOOGERWERF; Banten, Pandeglang, Trouwerseiland, at sea coast: FOR. RES. INST. Ja. 2598.

BALI — Prapatagoeng, frequent in rain forest on limestone, 100—300 m alt.: VAN STEENIS 7667, nat. n.: *sawo ketjip*.

SOEMBAWA — Kangga, 5 m alt.: FOR. RES. INST. bb. 12036, nat. n: *sawo kala*.

BANDA — COLL.? s. n.

NEW GUINEA — Papua, Western Div., Daru Isl.: BRASS 6443; Mabaduan: ID. ? 6476, common on granite slopes along coast.

N. AUSTRALIA — Warrior Isl.: LE GUILLOU, A° 1841.

D i s t r i b u t i o n: Siam, Cochin China, Burma, Malay Peninsula, Sumatra (P. Weh), Java, Karimoendjawa, Madoera, Kangean, Bali, Boetoeng, Jolo (Phil. Isl.), Soembawa, Banda, New-Guinea, N. Australia (Torres Str.).

R e m a r k s: Rather variable as to the shape of the leaves and the proportion of leaf-length and length of petioles (1.7—6.2, but mostly about 3); also regarding the situation and the dimensions of the seed scar. Remarkably broad scars were found in a cultivated specimen (Java, Tjipakoe, leg. OCHSE), in which they were 0.65—0.95 × 0.32—0.35 cm, but as perfectly normal seeds were also extant under the same number (scar 1.0 × 0.18 cm), this condition should not be overestimated. In a specimen from Warrior Isl. (leg. LE GUILLOU) the only seed extant was exceptionally large, viz. 2.25 × 1.30 × 1.05 cm, the scar being 1.4 by 0.31—0.39 (broader above). The specimen BRASS 6467 from Papua is somewhat doubtful, being distinguished by small and relatively very broad leaves (about 6 × 4.5 cm) with very short petioles (about 1.5 cm) and short fruit pedicels (1.2—1.7 cm).

4. **Manilkara celebica** H. J. LAM, nov. spec. — *Fig. 4* — Arbor mediocris. *Folia* eis *Manilkara Kauki* similia, sed basi semper acuta (angulo basali 80°—90°), apice rotundata vel paulo emarginata, 5.5—11.1 cm longa, 3.5—6.7 cm lata, petioli 1.6—3.6 cm longi; nervi angulo c. 40°—50° adscendentes. *Alabastra* clavata, pedicellis gradatim incrassatis, pubescentibus, 1.4—1.5 cm longis. *Sepala* 3 + 3, pubescentia, oblongo-acuta, c. 1 cm longa, 0.4 cm lata. *Corolla* glabra, c. 0.8 cm longa, appendicibus dorsalibus c. $^{2}/_{3}$ petalorum longitudine. *Stamina* filamentis brevibus c. 0.5 cm longa; *staminodia* oblongo-lanceolata staminibus breviora, apice grossedentata. *Ovarium* usque ad basin pubescens, haud disco suffultum, 6-sulcatum, 6-loculatum, in stylum filiformem c. 0.9 cm longum contractum. *Fructus* ignoti.

A tree with white latex, about 25 m high, branchlets 0.4—0.5 cm thick, the older ones verrucose. *Leaves* crowded at the tips of the branchlets, estipulate, rigid, obovate, apex broadly rotundate or slightly emarginate, base acute (basal angle 80°—90°), glabrous above, lower side with a sparse and appressed ferruginous silky indumentum, glabrescent, 5.5—11.1 by 3.5—6.7 cm, petioles 1.6—3.6 cm, slender; midrib depressed above, prominent below; secondary nerves very slender, about 13 on either side, straight or mostly somewhat curved, ascending at an angle of 40°—50°, this angle diminishing towards the apex, close to the margin archingly joined, tertiary nerves, slightly fainter and 1—3 parallel between each pair of secondary ones, with a minute, longitudinally stretched reticulation between them. *Flowerbuds* obtusely club-shaped, the pedicel gradually incrassate, appressedly pubescent as is the calyx. Pedicels 1.4—1.5 cm long, one or two in a leaf axil. *Sepals* 3 + 3, oblong, acute, greyish tomentose without, brownish within, the outer ones 0.95—1.0 by 0.35—0.45 cm, the inner ones 0.9 by 0.35 cm. *Corolla* glabrous, tube about 0.08 cm, petals 6, obtusely oblong, about 0.7 by 0.3 cm, the dorsal appendages about two thirds their length, lanceolate with minutely undulate margins at base, and acute apex, 0.45—0.5 by 0.15 cm. *Stamens* 6, 0.45—0.5 cm long, with short filaments (0.15—0.2 cm long), anthers minutely apiculate, 0.35—0.4 by 0.1—0.15 cm; *staminodes* 6, oblong-lanceolate, 0.25—0.4 by 0.1—0.15 cm, margins undulate at base, the upper half with some irregular teeth. *Ovary* pubescent down to the base, without disc, 6-furrowed and 6-celled, contracted into the filiform style, which is 0.9—0.95 cm long. *Fruit* unknown.

CELEBES — Res. Manado, dist. Boalemo, na. Bilato, about 50 m alt.: FOR. RES. INST. bb. 16.979 (*type specimen*, Herb. Buitenz., Herb. Leiden; flow. in May; nat. [Gorontalo] name: *timbocwolo*); same locality, 300 m alt., some specimens

together, in old dry forest on slope: ID. bb. 19.401 (tree, 24 m high, bole 11 m, diam. 0.73—0.54 m, nat. [Gorontalo] name: *timbocalo*, ster.); Res. Manado, dist. Posso, nr. Kotamboea (Mawoeroto), 50 m alt., rather scarce, in dry old forest: FOR. RES. INST. bd. 19.637 (tree, 25 m high, bole 10 m, diam. 0.53—0.46 m, nat. [Bare'e] name: *komea*).

Remarks: A species closely related to *M. Kauki*, but distinctly different by its leaves with acute base and the small angle of the nerves, the club-shaped flowerbuds with incrassate pedicels, the longer sepals, the petal-appendages being shorter than the petals, the larger anthers, the narrow staminodes and the ovary without disc.

5. **M. hexandra** (ROXB.) DUB., Ann. Mus. Col. Mars. **23**, 1915, 9, fig. 2; MERRILL, Lingn. Sc. Journ. 14, 1935, 47 — *Mimusops hexandra* ROXB., Pl. Corom. I, 1795, 16, t. 15; CLARKE in HOOKER F., Fl. Br. Ind. III, 1882, 549; BRANDIS, Indian Trees 1906, 425, fig. 163; COOKE, Fl. Bombay II, 1908, 95; GAMBLE, Fl. Pres. Madras IV, 1921, 766 — *M. indica* A. DC., Prodr. VIII, 1844, 205; WIGHT, Ic. Pl. IV, 1850, t. 1587 — *Fig. 5*.

A tree, up to 20 m high, with greyish bark, very hard and red wood and dense foliage. *Leaves* more or less crowded at the tips of the branchlets, estipulate, shiningly green on either side, rigid, entirely glabrous, oblong or ellipsoid to slightly obovate, base broadly acute to (sub)rotundate, apex rotundate and usually distinctly emarginate, 3.4—11 by 2.3—6.7 cm long, petiole short, sulcate above, 0.4—2.3 cm long; midrib depressed above, prominent below; secondary nerves 13—18, slender but conspicuous, straight, ascending at an angle of 65°—75°, near the margin high archingly joined, tertiary nerves 1 to 3 parallel between each pair of secondary ones, with a minute reticulation between. *Flowers* comparatively small, about 0.7 cm wide, 1—4 in the leaf-axils, pedicels 0.8—0.9 cm long, not elongate in fruit, glabrous or nearly so, as are the outer sepals. *Sepals* 3 + 3, deltoid, 0.4—0.45 cm long, the inner ones more tomentose and narrower. *Corolla* white, glabrous, tube 0.1 cm long, petals 6, lanceolate, 0.3—0.35 by 0.1 cm, the appendages slightly longer, 0.35—0.4 by 0.1 cm. *Stamens* 6, the filaments filiform and about 0.25 cm, the anthers acutely ovoid, about 0.2 cm long; *staminodes* 6, bifid or dentate, 0.25 cm long. *Ovary* furrowed, tomentose but with a shallow, glabrous disc, 12—9(—6)-celled, contracted into a filiform style of about 0.5 cm long. *Fruit* ovoid to subglobose, reddish-yellow, 1—1.4 cm long, (2- or) 1-seeded, pericarp rather dry. *Seeds* reddish-brown, flattened, 1—1.2 × 0.6 × 0.35 cm, scar basiventral, 0.5—0.6 × 0.1—0.18 cm, wider at top end, testa thin, about 0.02 cm.

Exsiccatae examined in Herb. Leiden (cultivated specimens excepted):

INDIA: Deccan Peninsula: LESCHENAULT.

SIAM: ? COLL. 1996; KERR 16130.

COCHIN CHINA: Prov. Bien Hoa, Tri Huyen: Herb. PIERRE 3261; Baria, Mt. Dinh: Herb. PIERRE 3261.

INDO-CHINA: Annam: J. & M. S. CLEMENS 3200.

Distribution: In evergreen dry forests in Deccan Peninsula, Ceylon, Siam, Indo-China, Hainan (f. MERRILL, l. c.).

6. **M. udoido** KANEHIRA, Bot. Mag. Tokyo, **47**, 1933, 677, in Fl. Micrones. 1933, 304, fig. 154 and in Journ. Dept. Agr. Kyushu Imp. Univ. **4**, 1935, 388 — *Fig. 6.*

A medium-sized tree, 8—20 m high. Branchlets rather thick (0.4—0.8 cm) and scarred. *Leaves* crowded at the tips of the branchlets, estipulate, both sides the same colour when dry, entirely glabrous, very rigid, oblong-obovate to oblanceolate with cuneate to attenuate base and rounded (rarely slightly emarginate) to (in young specimens) acute apex, (3.5—) 7—10 (—13) by (1.7—) 2.5—4 (—5) cm, petioles (1.2—) 1.6—2.3 (—2.8) cm long, sulcate above. Midrib depressed above, prominent below. Nervation of the type of *M. calophylloides* and *fasciculata*, the secondary nerves (about 15) hardly stronger than the tertiary nerves, close to the margin united to form a distinct intramarginal nerve, all nerves straight or nearly so and striate, ascending at an angle of 60°—70°. *Flowers* solitary or 2—3 in the leaf-axils, the pedicels curved downward, glabrous and hardly or not incrassate towards the small, ovoid bud, 2.2—3.5 cm long. *Sepals* 3 + 3, ovate, broadly acute to subrotundate, minutely tomentose outside but glabrescent, glabrous within except the margin, 0.45—0.55 by 0.3 cm. *Corolla* glabrous, the tube thick, 0.1—0.2 cm long; petals 6, oblong with broadly acute tip, 0.35—0.42 by 0.12—0.15 cm, appendages acutely oblong, 0.3—0.35 by 0.1—0.15 cm. *Stamens* 6, the stout filaments about 0.2 cm long, the oblong anthers 0.2—0.25 cm; *staminodes* 6, thick and scale-like deltoid or subtruncate with undulate margin, sometimes with 1—3 protracted teeth, 0.1—0.2 by 0.1—0.15 cm. *Ovary* minutely pubescent, without disc, 6-furrowed, 6-celled, contracted into a rather short style of 0.5—0.7 cm long. *Fruit* 1-seeded, oblong, about 1.5 by 1 cm. *Seeds* oblong, pointed below, about 1.2 by 0.5 cm, the scar more than half as long as the seed and narrow, about 0.8 × 0.18 cm, testa for the genus very thin (0.02 cm).

CAROLINE ISLANDS — Palao Isl., no further locality: KRAEMER s. n. (ster. in Herb. Berl.); Ibid., Babelthaop, nr. Ngatkip, in forest, 100 m alt.: LEDERMANN

14491 (tree, 15—20 m high, with broad crown, flowers white, fragrant, fruit red, leaves dull green with yellowish green lower side and pale-yellow midrib, bark light-grey, buds on 6. 3. 1914, nat. name: *auduidh*; Herb. Berl.); same locality: Ib. 14510 (large shrub, 1—1.5 m high, bark light-grey, latex extant, leaves shiningly dark green, ster.; Herb. Berl.); Ibid., Babeldaob: S. NISIDA 2776 (fl.; Herb. Leiden); Ibid., Girikiai, forest, rare: M. TAKAMATSU 1751 (tree, flow. Apr.; Herb. Leid.).

Remark: The native name is "*udoido*" (KANEHIRA), or "*auduidh*" (LEDERMANN).

7. **M. Merrilliana** H. J. LAM, nov. nom. — *M. calophylloides* (MERR.) H. J. LAM, Bull. Jard. bot. Buitenz. Sér. III, 7, 1925, 240, 268 and 8, 1927, 481 — *Mimusops calophylloides* (not of BAILLON 1892 in CORDEMOY 1895) MERRILL, Phil. Journ. Sci., Sect. C, **10**, 1915, 337 and Enum. Phil. Flow. Pl. III, 3, 1923, 288 — *Fig. 7.*

A lofty tree. Branchlets slender, 0.2—0.4 cm thick. *Leaves* estipulate, entirely glabrous, more or less conferted (but not many) at the tips of the branchlets, bright- to dark-brown when dry, rigid, somewhat shining above, dull below, oblong or oblong-obovate, apex rounded to slightly acute and shortly and bluntly acuminate, base cuneate to broadly acute, 5.2—12.5 (—16) by 2.4—5.5 (—6.3) cm, petioles 1—3 (—3.7) cm long; midrib depressed above, prominent below; secondary nerves not or hardly distinguishable from the tertiary ones, all nerves close together, about 20 to a cm, striate, with a longitudinally stretched reticulation, straight or very faintly curved, angle (60°—)70°—80°, uniting to form a distinct submarginal nerve about 0.1 cm from the edge of the leaf. *Flowers* solitary or two to three in the axils of the leaves (only buds known), minutely velvety tomentose, the pedicels hardly 1 cm long, gradually incrassate towards the bud, the ovoid buds 0.5 cm long. *Sepals* 3 + 3, acutely deltoid, the inner ones narrower. *Corolla* glabrous, petals 6, ovate, appendages (in young bud) probably about $^2/_3$ as long as the petals, narrowly oblong. *Stamens* 6; filaments broadened at base, the anthers in the bud sagittate, glabrous; *staminodes* ovate to oblong, with some (often 3) teeth. *Ovary* minutely appressedly pubescent, without disc, 7—6-celled, style short and stout, glabrous. *Fruit* (f. MERRILL) globose, 2—2.5 cm in diam., brown when dry, tipped by the very short style, glabrous, the pericarp brittle, 1—2-seeded. Seeds brown and shining, obtuse, about 1.5 by 1 cm, slightly compressed.

In addition to the specimens quoted earlier, the following exsiccatae have to be mentioned:

CELEBES — Celebes & Dependencies, Malili, nr. Laroei, 400 m alt., on steep

slope in old forest: FOR. RES. INST. bb. 19.574 (tree, 40 m high, bole cylindrical, 30 m, diam. 1.24 m at a height of 1.8 m, latex white, abundant, nat. [loewoe] n.: *koemea*).

MOROTAI — W. Morotai, E. of Pilowo, G. Ligoir nr. Goegoeti, 100 m alt., old forest on limestone, several specimens together: H. J. LAM 3584 (tree, about 30 m high, bole cylindrical ± 20 m, diam. 0.6—0.4 m, wood very hard, bark rough and dark brown; branchlets grey-brown; leaves bright green, above darker than below, the petiole and the midrib lighter; nat. [alifoeroe] n.: *ligoir*; latex abundant, white, sticky and thick; formerly identified as *Northia fasciculata* [WARB.] H. J. LAM).

Distribution: Philippines (Luzon, Samar, Mindanao), Celebes (Central), Morotai.

Remarks: It is a pity that the few specimens known of this interesting species bear no open flowers and that MERRILL's description does not mention the shape of the scar on the seed. As to the leaf characters, it is certainly related to *M. fasciculata*, but the dorsal appendages and the staminodes are much larger. Likewise, the distribution points to an alliance with that species, *M. Merrilliana* being probably one of those species which mark the Central Moluccas — Central Celebes — Philippines migration track (cf. H. J. LAM, Blumea **3**, 1938, 144—146).

M. Merrilliana is a very high and stately forest tree; the field label of the Celebes specimen quoted above gives strikingly the same points which characterized the specimens, I observed myself in Morotai, where I measured a tree with a trunk of 1.80 m diam. at a height of 1.5 m. The ovary is minutely pubescent, not glabrous, as is mentioned by MERRILL.

8. **M. fasciculata** (WARB.) H. J. LAM & MAAS GEESTERANUS, nov. comb. — *Mimusops fasciculata* WARB., ENGL. Bot. Jahrb. **13**, 1891, 401; KRAUSE, ENGL. Bot. Jahrb. **58**, 1923, 486 — *Mimusops Teysmanni* PIERRE in DUBARD, Ann. Mus. Col. Mars. **23**, 1915, 12, fig. 4 — *Northia fasciculata* (WARB.) H. J. LAM, Bull. Jard. bot. Buitenz. Sér. III, 7, 1925, 241, fig. 63 — *Fig. 8*.

A tree, about 15 m high. Branchlets rather thick (0.7—0.8 cm), rough. *Leaves* estipulate, many of them crowded at the tips of the branchlets, rather rigid, brown when dry (hardly darker above), oblong or elliptic to somewhat obovate, base acute or slightly attenuate, apex rounded, often somewhat emarginate, 10—13 by 5.2—7 cm, petioles long, 3—4.1 cm; midrib somewhat sulcate above, prominent below; secondary nerves very slender, 25—30, ascending at an angle of about 75°, straight or nearly so, near the margin united into a distinct

intramarginal nerve, the tertiary ones only slightly fainter, parallel and connected by a more or less longitudinally stretched reticulation, extending even beyond the intramarginal nerve. *Flowers* 2—5 in the upper leaf-axils, pedicels slender, 1.3—1.6, in fruit 2.2—3 cm long, cinereous white, as are the sepals outside. Outer 3 *sepals* narrowly deltoid, about 0.4 by 0.22 cm, acute, the inner 3 ones narrower and oblong-ovate. *Corolla* glabrous, the tube 0.13 cm long, petals 6, ribbon-shaped, 0.5—0.6 by 0.1 cm, apex subacute to somewhat truncate and denticulate, appendages subulate, 0.1 cm broad at base, ± 0.4 cm long. *Stamens* 6, the filaments stout and 0.25 cm long, anthers 0.25 cm, acuminate; *staminodes*, if any, filiform, 0.2—0.3 cm long, 0.05 cm broad at base, often wanting. *Ovary* tomentose without a disc, 6-celled, contracted into a style which is 0.8—0.9 cm long. *Fruit* 1-seeded, obovoid with rather dry pericarp, 2.7—3.3 by 1.8—2.1 cm. *Seeds* with a very thick and hard testa, 2.2—2.7 × 1.4—1.6 × 1.1—1.3 cm, testa 0.2 cm thick, scar basiventral, ovate, about 1.2—1.5 × 0.75—0.8 cm.

Distribution: W. New Guinea, Kai Isl. (f. KRAUSE).

9. **M. Roxburghiana** (WIGHT) DUB., Ann. Mus. Col. Mars. **23**, 1915, 10, fig. 3 — *Mimusops Roxburghiana* WIGHT, Ic. Pl. IV, 1850, t. 1588; CLARKE in HOOKER F., Fl. Brit. Ind. III, 1882, 548; BRANDIS, Indian Trees, 1906, 425; J. S. GAMBLE, Fl. Pres. Madras IV, 1921, 766 — *Manilkara Roxburghiana* (WIGHT) PARKER, Ind. Forester **57**, 1931, 489.

A large tree. *Leaves* rigid, glabrous, ovate or slightly obovate, not crowded at the tips of the branchlets, rounded or slightly subcordate at base, often somewhat emarginate at apex, about 7.5 by 4.5 cm, petioles 1.2—1.8 cm. *Flowers* 2—4 in a leaf-axil, pedicels about 2.5—3.5 cm long, almost glabrous. *Sepals* 3 + 3, triangular-lanceolate, mealy-tomentose, about 0.8—0.9 cm long. *Corolla* about 1 cm long, with a comparatively long tube (0.3 cm, f. DUBARD); petals 6, oblong-lanceolate, appendages more acute and as long as the petals. *Stamens* 6 with filiform filaments and ovoid anthers; *staminodes* 6, slightly longer than the filaments, ovate to oblong, irregularly dentate. *Ovary* 9—?-celled. *Fruit* globose, depressed above, 6—3-seeded, about 1.2 cm in diam. *Seeds?*

Distribution: India, Western Deccan Peninsula (Nilgiri, Anamalais), in dry forests.

Remarks: No specimens examined. Incompletely known to us. WIGHT's picture shows 8-merous as well as 6-merous flowers but CLARKE and DUBARD mention 6 as the number of calyx and corolla, although that of the staminodes is sometimes given as 6—8 (also for

M. hexandra). Nothing is known to us concerning the venation type and the seed-scar.

10. **M. kanosiensis** H. J. LAM & B. MEEUSE, nov. spec. — *Fig. 9* — Arbor parva. *Folia* haud conspicue ad ramulorum apices conferta, estipulata, glabra, coriacea, obovata, basi acuta, apice rotundata, saepe paulo emarginata, 5—9 cm longa, 3.3—4.8 cm lata, petioli 1.2—2.7 cm longi. Costa media subtus prominens. Nervi secundarii pergraciles, c. 12—15, angulo 60°—70° adscendentes, prope marginem nervo intramarginalem subarcuatim conjuncti, tertiarii paralleli reticulatione minuta. *Flores* 0.9—1.2 cm longi, axillares, 1—3 in axilla, pedicelli 1.5—1.8 cm longi, cum calycibus minute adpresse pubescentes. *Sepala* 3 + 3 deltoideo-lanceolata, acuta 1—1.1 cm longa, interiora angustiora. *Corollae* glabrae haud exsertae tubus 0.2 cm longus, petala 6 oblongo-lanceolata obtusa, 0.6—0.7 cm longa, 0.2—0.25 cm lata, appendicibus dorsalibus lanceolatis, c. 0.35 cm longis. *Stamina* 6, filamentis solidis 0.1 cm longis; antheris oblongis, 0.3 cm longis; *staminodia* 6 lata, irregulariter dentata, acuminata, c. 0.3 × 0.15 cm. *Ovarium* perminute pubescens, basi disco glabro adnato cinctum, subabrupte in stylum subulatum 1.2—1.8 cm longum contractum, (7—)6-loculatum. *Fructus* ignoti.

A small tree with white latex, about 7 m high. Branchlets 0.3—0.5 cm thick. *Leaves* not conspicuously conferted at the tips of the branchlets, estipulate, dark brown when dry, coriaceous, not very rigid, glabrous, obovate with acute base and rounded or slightly emarginate apex, 5—9 by 3.3—4.8 cm, petioles 1.2—2.7 cm long. Midrib depressed above, prominent below, secondary nerves 12—15, straight or slightly curved, very slender, ascending at an angle of 60°—70°, near the margin more or less archingly joined, tertiary ones hardly conspicuous, parallel, 1—3 between each pair of secondary nerves, with a minute reticulation between. *Flowers* 1—3 in the axils of the uppermost leaves, pedicels minutely appressedly tomentose, as are the sepals outside, 1.5—1.8 cm long. *Sepals* 3 + 3, pale grey-green, the outer ones acutely triangular and about 1.1 by 0.5, the inner ones acutely oblong and about 1 by 0.35 cm. *Corolla* pale greenish white, glabrous, the tube about 0.2 cm long, thick, the 6 petals obtusely oblong, about 0.65 × 0.2—0.25, the appendages slightly more than half as long, 0.35 by 0.1 cm with long tapering tip. *Stamens* 6, the stout filaments about 0.1 cm long, the oblong and subacute anthers 0.3 cm; *staminodes* 6, with thick basis and fan-like blade with irregularly dentate margin and a long protracted acumen, about 0.3 × 0.15 cm. *Ovary* very minutely pubescent, older ones glabrescent, at base surrounded by a glabrous

more or less undulate or angular adnate disc, (7—)6-celled, subabruptly contracted into the long and subulate style, which is 1.2—1.8 cm long and often slightly curved. Ovules basiventrally attached. *Fruit* unknown.

New Guinea — Papua, Kanosia, edge of mangrove swamp, sea level: C. E. Carr 11237 (*type specimen* in Herb. Leid., flow. in Febr.).

11. M. samoensis H. J. Lam & B. Meeuse, nov. spec. — *Fig. 10* — Arbor? Ramuli verrucosi. *Folia* nonnulla ad ramulorum apices conferta estipulata, i. s. fusca, coriacea, glaberrima, ± concoloria, oblonga, basi ± late acuta ad subrotundata, apice obtusa, 7.5—13.5 cm longa, 3.2—5.1 cm lata, petioli supra sulcati 2.3—3.6 cm longi. Costa media supra paulo depressa, subtus prominens. Nervi secundarii in foliis adultis inconspicui, c. 15, recti, angulo c. 85° de costa adscendentes, tertiarii gracillimi paralleli, reticulatione perminute areolata supra conspicua. *Flores* in foliorum axillis solitarii vel bini, pedicellis ferrugineo-tomentosis, 1.5—1.9 cm longis, alabastra anguste oblonga acuta c. 1.5 cm longa 0.5 cm lata versus sensim incrassatis, saepe reflexis. *Sepala* 3 + 3, oblongo-lanceolata, exteriora ferrugineo-tomentosa, interiora sericea, omnia intus apice sparse pubescenti excepta glabra, 1.1—1.4 × 0.35—0.5 cm. *Corollae* glabrae tubus 0.2 cm altus, petala 6 late lineata, 1.1—1.3 cm longa, 0.2 cm lata, obtusa vel acuta, appendicibus e basi ± 0.2 cm latis sensim angustatis, usque ad 0.75 cm longa. *Stamina* 6, filamentis basi dilatatis, apice filiformibus, 0.6—0.75 cm longis, antheris acuminatis c. 0.5 cm longis; *staminodia* oblongo-ovata, irregulariter dentata vel subtrifida, 0.3—0.6 cm longa, 0.2—0.3 cm lata. *Ovarium* conicum adpresse pubescens, 9-loculatum, 0.25 cm altum, in stylum glabrum 1.3—1.8 cm longum sensim contractum; ovula basiventraliter affixa. *Fructus* ignoti.

A tree? Branchlets about 0.5 cm thick, scarred. *Leaves* entirely glabrous, coriaceous and rigid, dark brown when dry, estipulate, rather conferted at the tips of the branchlets, oblong, base ± broadly acute to subrotundate, apex blunt, 7.5—13.5 cm long, 3.2—5.1 cm broad, the petioles sulcate above and 2.3—3.6 cm long. Midrib depressed above, strongly prominent below; secondary nerves hardly conspicuous in adult leaves, about 15, arising at an angle of about 85°, near the margin faintly and broadly archingly joined, tertiary nerves about 3 between each pair of secondary ones, but still fainter, an areolate and very minutely bullate reticulation conspicuous above. *Flowers* one or two in a leaf-axil, the pedicels and the outer sepals ferruginously tomentose, pedicels 1.5—1.9 cm long, curved downwards, incrassate

towards the buds which are narrowly oblong and acute and about 1.5 cm long and 0.5 cm in diam. *Sepals* 3 + 3, oblong-lanceolate, the outer ones about 1.25 × 0.45, the inner ones 1.5 × 0.35, inner ones sericeous outside, all sepals glabrous inside except near the apex where they are sparsely pubescent. *Corolla* glabrous, the tube 0.2 cm high, petals 6, ribbon-shaped and about 1.3 × 0.2 cm, appendages 0.2—0.25 cm broad at base, tapering into a filiform apex, 0.5—0.75 cm long. *Stamens* 6, the filaments broad at base, filiform at apex, 0.6—0.75 cm long, anthers acuminate, about 0.5 cm long; *staminodes* oblong-ovate, irregularly dentate or subtrifid, 0.3 -0.6 × 0.2—0.3 cm. *Ovary* conical, without disc, appressedly pubescent, 9-celled, 0.25 cm high, gradually contracted into the stout style, which is 1.3 -1.8 cm long; ovules basiventrally attached. *Fruit* unknown.

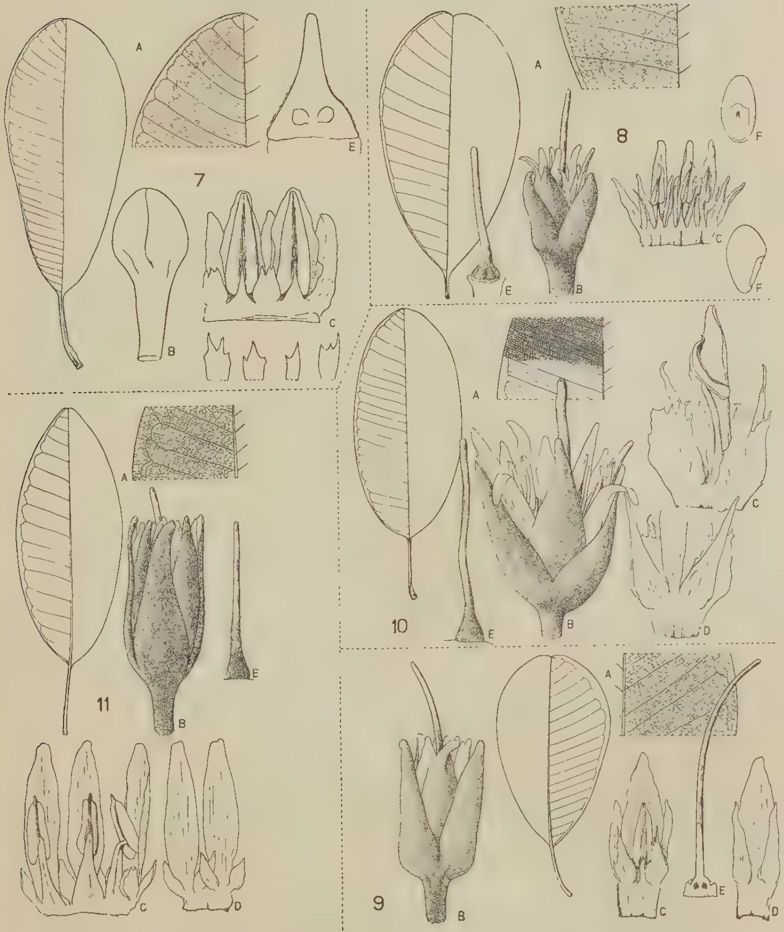
SAMOA: Rev. S. J. WHITMEE 226 (*type specimen* in Herb. Kew).

12. M. vitiensis (H. J. LAM & E. VAN OLDEN) B. MEEUSE, nov. comb. — *Northia vitiensis* H. J. LAM & E. VAN OLDEN, B. P. Bish. Mus. Bull. 141, 1936, 163, fig. 83 — *Fig. 11.*

A small tree, about 7 m high. Branchlets slender, greyish. *Leaves* estipulate, crowded (but not many) at the tips of the branchlets, entirely glabrous, pale greyish green but the young ones dark brown when dry, rigid, elliptic- or oblong-obovate, base broadly acute to subrotundate, apex obtuse, 9—12 by 3.5—5 cm, petioles slender, sulcate above, 2—4.5 cm long. Midrib depressed above, strongly prominent below; secondary nerves very faint, about 13—15, ascending at an angle of about 70°, straight or nearly so but slightly sinuate, near the margin rather high archingly joined; tertiary nerves mostly one between each pair of secondary ones, still fainter, with a minute but distinct reticulation between. *Flowers* 1 or 2 in the axils of the leaves, the pedicels 1.5—2.5 cm long, sparsely tomentose and slightly incrassate towards the narrowly oblong and acute buds, which are about 1 cm long and 0.3—0.4 cm across. *Sepals* 3 + 3, sparsely tomentose without, oblong-lanceolate, 1.1—1.2 by 0.25 (inner)—0.35 cm, the inner ones thinner and with woolly margins. *Corolla* white, tube 0.15—0.2 cm long, petals 6, oblong obtuse, 1—1.2 × 0.2—0.25 cm, appendages about 0.25 by 0.1 cm, lanceolate. *Stamens* 6, the filaments stout and broadened at base, 0.4 cm long, anthers oblong, apex mucronulate, base sagittate, 0.35 cm long; *staminodes*, if any, thin and ovoid or almost circular with denticulate margins, about 0.2 × 0.2 cm, but the two halves folded together, often wanting. *Ovary* narrow, minutely

del. C. Mulder & C. Marks.

MANILKARA — Fig. 1, *M. dissecta* (Powell 187) — 2, *M. Smithiana* (type spec.) — 3, *M. Kauki* (H. L. 908.225—321) — 4, *M. celebica* (type spec.) — 5, *M. hexandra* (Pierre 3261, Tri Huyen) — 6, *M. udoido* (Nisida 2776) — 7, *M. Merrilliana* (Ponce 22834, type spec.) — 8, *M. fasciculata* (cult. Hort. Bog.



del. C. MULDER & C. MARKS.

sub IV. B. 19) — 9, *M. kanosiensis* (type spec.) — 10, *M. samoensis* (type spec.) — 11, *M. vitiensis* (type spec.) — In all figures: A. leaf and nervation; B. flower or flowerbud; C. part of corolla inside so as to show the stamens and the staminodes; D. part of corolla outside so as to show the appendages; E. ovary and style; F. seed.

pubescent, more or less 6-furrowed, 6-celled, gradually contracted into a tapering style of 1.2—1.3 cm long. *Fruit* unknown.

Distribution: Fiji (on sea cliff: A. C. SMITH 1461, *type specimen* in Herb. Leid.).

Remark: The ovary is pubescent, not glabrous, as was mentioned in the original description.

Incompletely known are:

13. M. emarginata H. J. LAM, Bull. Jard. bot. Buitenz. Sér. III, 7, 1925, 241.

A tree? Branchlets glabrous, the *leaves* crowded at their tips, subcoriaceous, i. s. dark-brown, above darker than below, entirely glabrous, ± obovate, the broad base minutely contracted into the petiole, apex rotundate and always emarginate, 4.7—8.7 by 3.3—6.4 cm. petioles canaliculate above, stout, 1—2 cm long. Midrib sulcate above, strongly prominent below; secondary nerves 15—17, very slender but conspicuous, in the middle of the leaf arising at an angle of 75°, in the leaf-base of 90°, in the apex of 55°, near the margin archingly joined; tertiary nerves very regularly and minutely reticulate. *Flowers* unknown. *Fruit* glabrous, 2—4 in the leaf-axils or their scars, the the pedicels 1 cm long. *Sepals* 3 + 3, the outer ones deltoid, 0.4 cm long and glabrous on either side, the inner ones narrower, 0.5 cm long, sericeous outside with scarious margins, glabrous within. *Fruit* oblong-ellipsoid, 1.7—1.8 × 0.7—0.8 cm, at the apex bearing the remainder of the style, 1-seeded. *Seed* small, 1.3 × 0.6 × 0.3 cm, with thin testa, the scar basiventral, lanceolate and narrow.

Distribution: Hawaii Isl., Oahu (CURRAN 132, *type specimen*).

Remark: During our recent investigations the type specimen was not at hand (nor any other); therefore the comparison with the other species was difficult, the more so since flowers are as yet unknown.

14. M. Kurziana H. J. LAM & B. MEEUSE, nom. nov. — *Mimusops parvifolia* KURZ, Prelim. Rep. For. Veg. Pegu, App. A, LXXIV, 1875, nomen and For. Fl. Brit. Burma II, 1877, 124 — *Manilkara parvifolia* (KURZ) H. J. LAM, Bull. Jard. bot. Buitenz. Sér. III, 7, 1925, 269.

The specific name *parvifolia* is invalidated by *Manilkara parvifolia* (RADLK.) DUB. (= *Mimusops parvifolia* RADLK. 1882 non *Mim. parvifolia* R. BR. 1810 which is *Mim. Elengi* L. 1753 var. *parvifolia* [R. BR.] H. J. LAM 1925) from the Bahamas.

Small tree, young shoots tomentose. *Leaves* ovate or obovate, glabrous, acute at base, somewhat emarginate at apex, petioles about 1.2 cm long. *Flowers* like those of *M. Kauki,* pedicels long and glabrous. *Sepals* 3 + 3, *petals* linear-lanceolate.

Distribution: Burma.

Remarks: Very incompletely known. No specimen examined by us.

15. M. littoralis (Kurz) Dubard, Ann. Mus. Col. Mars. **23**, 1915, 11 — *Mimusops littoralis* Kurz, Journ. As. Soc. Beng. **45**^{2}, 1876, 138 and For. Fl. Brit. Burma II, 1877, 123; Clarke in Hooker f., Fl. Brit. Ind. III, 1882, 549; Brandis, Indian Trees, 1906, 426.

A large tree, up to 25 m high, all parts quite glabrous, branchlets very thick and scarred. *Leaves* crowded at the tips of the branchlets, obovate to obovate-oblong, thin-coriaceous, more or less acute or cuneate at base, apex blunt and usually emarginate, 6.2—18.5 by ?—9 cm, petioles 1.2—2.4 cm; lateral nerves crowded with a minute reticulation between. *Flowers* small, solitary in the leaf-axils, pedicels 1.2—1.8, in fruit up to 3.5 cm, almost glabrous. *Calyx* about 0.5 cm long, *sepals* 3 + 3, ovate and rather blunt. Appendages to the 6 *petals* as long as or slightly longer (and broader) than these. *Stamens* 6, *staminodes* 6, scale-like and denticulate. *Ovary* tawny-pubescent, 9-celled (f. Dubard). *Fruit* depressedly globose, 2.5—3.5 cm in diam., 6—5-seeded, the *seeds* flattened, about 1.2 cm long, scar basiventral.

Distribution: Tenasserim, Andamans, Nicobars, Cocos I.

Remarks: Not examined by us. According to Dubard the species is closely related to *M. hexandra*, according to Clarke it is allied to *M. Kauki.* Unfortunately the species is insufficiently known.

During a short stay at the Paris Herbarium in January 1937 I made an annotation that the two specimens, preserved there under the name of *M. littoralis,* are probably conspecific with *M. hexandra.*

NORTHIOPSIS Kanehira

Northiopsis Kanehira, Bot. Mag. Tokyo 47, 1933, 677.

Trees of the description of *Manilkara,* but without dorsal appendages to the petals.

Thusfar monotypic. The only species bears flowers which are exceptionally large for the group, much larger than in *Manilkara samoensis,* the *Manilkara*-species with the largest flowers, but they are considerably smaller than those of *Northia seychellana.*

Remarks: During the elaboration of the Malaysian Sapotaceae, the result of which was published in 1925, the senior author considered WARBURG's *Mimusops* (now *Manilkara*) *fasciculata* a new species of *Northia*, *N. fasciculata* (WARB.) H. J. LAM on account of the very scanty petal-appendages, the often wanting staminodes and the large oval scar on the seed. At the time it was overlooked that, apart from the very large leaves, flowers and fruit, the very large seed-scar and the long corolla-tube, *Northia* is exalbuminous, whilst *Manilkara fasciculata* is provided with a copious albumen, as, in fact, all *Manilkara*-species are.

In 1932 KANEHIRA described a tree from the Carolines, pointing out that, according to LAM's arrangement of the genera his new species would fall under *Achras* except for its having 6 instead of 10—12 carpels. As its vegetative characters, however, were resembling those of *Northia* and *Manilkara*, he took it that his species should rather belong to one of these genera. Although any trace of dorsal appendages was wanting, it was decided that the species could be best inserted in *Northia*, since in that genus these organs show a certain tendency to be reduced in size. It was then named *Northia Hoshinoi* KAN.

Little more than a year afterwards, however, KANEHIRA found that the vegetative characters of *Northia Hoshinoi* are very different from those of *Northia* proper (giving no further arguments), on account of which he established a new genus *Northiopsis*, comprising one species now named *Northiopsis Hoshinoi* (KAN.) KAN., which was also mentioned in his studies on the flora of Micronesia.

As will be discussed more circumstantially underneath, we have come to the conclusion that it provisionally seems the most practical, although probably not the most logical procedure to follow KANEHIRA's opinion and to maintain *Northiopsis* as a separate genus.

Northiopsis Hoshinoi (KAN.) KAN., Fl. Micrones. 1933, 302, fig. 152, Bot. Mag. Tokyo **47**, 1933, 677 and Journ. Dept. Agr. Kyushu Imp. Univ. **4**, 1935, 388 — *Northia Hoshinoi* KAN., Bot. Mag. Tokyo **46**, 1932, 489.

A moderate-sized tree, 10—18 m high, trunk up to 1.2 m in diam. Branchlets very thick (0.8—0.9 cm) and scarred. *Leaves* crowded at the tips of the branchlets, coriaceous, entirely glabrous, not very rigid, estipulate, both sides light-brown, the young ones darker, when dry, elliptic-ovate, base broadly acute, basal angle about 90°, apex somewhat broader and often shortly and bluntly acuminate, (9—) 12—17 (—18.8)

by 5.5—9.2 cm, petioles stout, 2.5—4.2 cm long, sulcate above; midrib depressed above, strongly prominent below; secondary nerves very slender, straight, ascending at an angle of 70°—80° (in the apex somewhat less), 24—30 (—35, *type spec.*), near the margin faintly archingly joined; tertiary nerves very faint, about 3 between each pair of secondary ones and parallel to them, with a hardly conspicuous reticulation between. *Flowers* solitary or 2 in the leaf-axils, the pedicels and the calyx outside glossy golden-brown tomentose, pedicels short, in flower 0.7—1 (—2, *type spec.*) cm long, in fruit up to 1.5 cm and very much incrassate (0.3—0.4 cm thick), buds oblong, about 1.5 cm long and 0.6 cm across. *Sepals* 3 + 3, acutely oblong-elliptic, the outer ones 1.5—1.7 by 0.65—0.7 cm, the inner ones 1.5—1.7 by 0.35—0.4 cm, all silvery sericeous inside. *Corolla* white, glabrous, tube 0.2—0.25 (—0.4, *type spec.*) cm; petals 6, 1.75—2 by 0.4—0.6 cm at base, acute; appendages none. *Stamens* 6, the filaments filiform and somewhat flattened, glabrous (in the *type specimen* villose), 1—1.6 cm long, anthers acutely oblong-lanceolate, 0.5—0.6 cm long; *staminodes* acutely triangular to filiform or deeply bifid, 0.25—0.5 by 0.075—0.1 cm. *Ovary* pubescent as is the lower half of the tapering style, which is 1.8—2.5 cm long, the ovary 6-celled, 0.25—0.3 cm high, withouth disc. *Fruit* globular, 3—4 cm in diam., crowned by the base of the style; pericarp thick, but apparently rather dry. *Seeds* acutely pointed at apex, blunt at base, with a more or less sharp ventral keel, testa very hard and thick (0.15 cm), about 3.8 × 1.6 × 1.1 cm, the scar basiventral, pyriform, elongate-ovate, 1.6 × 0.7—0.8 cm; albumen abundant, surrounding the thin cotyledons and the pointed radicle.

CAROLINE ISLANDS — Ponape, Kolonia: HOSHINO 2138 (flow. & fr. March 1933).

SAMOA — Savaii: CHRISTOPHERSEN (E. STEHLIN) 2660 (ster., Sept. 1931, in Herb. Oslo and Herb. Honolulu; nat. name: *pau*; wood used for making war-clubs); nr. Falealupo, in forest, alt. 5 m: CHRISTOPHERSEN 3319 (tree, ster. Nov. 1931; in Herb. Honolulu; nat. name: *pau*).

Remarks: Although the Samoa specimens are sterile, their vegetative characters are so strikingly those of the Ponape specimen, that I hardly doubt, whether the identifications are correct.

Discussion.

The *Mimusopoideae*, as a subfamily of the Sapotaceae (cf. H. J. LAM, Rec. Trav. bot. néerl. **36**, 1939, 524), are characterized by cyclical flowers and by the possession of dorsal appendages to the petals and of staminodes. The two first-named characters seemed more

important to recent investigators than the staminodes, on account of which this group was formerly inserted by A. ENGLER in the *Palaquieae-Sideroxylinae*, which also possess staminodes but have an acyclical calyx and are missing the appendages.

Ever since DUBARD and LECOMTE (l.l. c.c. sub *Manilkara*) the trimerous and the tetramerous types of the subfamily have been considered to have their typological centres in the largest genera, *Manilkara* ADANSON and *Mimusops* L. respectively. The discriminating characters of these genera are:

	Manilkara	Mimusops
flower type	trimerous, very rarely tetramerous (cf. *Note 1*)	tetramerous
calyx	two whorls of 3 sepals, sepals mostly relatively broad;	two whorls of 4 sepals, sepals mostly relatively long and narrow;
corolla	tube with 6 petals, appendages mostly entire and about as large as the petals, rarely much smaller;	tube with 8 petals, appendages entire or laciniate, as large as or somewhat smaller than the petals;
stamens	6 epipetalous	8 epipetalous
staminodes	6 alternipetalous, mostly laciniate, dentate of fimbriate, bifid or trifid, mostly glabrous and erect with the stamens or patent with the petals, very rarely reduced to none	8 alternipetalous, always entire, often pubescent and incurved so as to cover the pistillum
carpels	15—6	8
ovules	ventrally affixed in the lower half of the cell to almost or completely basal	basally affixed
scar on the seed	usually basiventral, relatively long and narrow, on the basal half of the scar, rarely broader and ovate or circular and almost basal (cf. *Note 2*)	small and circular and almost basal, rarely somewhat elongate or ellipsoid (cf. *Note 2*)
leaves	often crowded at the tips of the branchlets, with sclereids and a very dense striate nervation (cf. *Note 3*)	mostly not conspicuously crowded, without sclereids, and mostly with a rather lax nervation

Notes to the above statement:

1. Two African species seem to be variable as to the number of their flower parts, viz. *M. spiculosa* (HUTCH. & CORB.) H. J. LAM, nov. comb. [1]), which is 3- or 4-merous, and *M. umbraculigera* (HUTCH. & CORB.) H. J. LAM, nov. comb. [1]), in which there may be 5, 3 + 3 or 4 + 4 sepals (cf. *Labourdonnaisia* and the remarks under *M. Roxburghiana*). From the description of the species mentioned we were inclined to conclude that the other characters are those of *Manilkara* rather than of *Mimusops*. Although the two genera meet, as it were, in these species, we prefer to keep them apart, even if other characters are more or less overlapping as well, such as the shape of the scar, the incision of the appendages, etc. These characters, each overlapping with its own pattern, hardly seem, however, to affect the separation of the two fundamental types. To a certain degree, it is a matter of taste, whether or not the two genera should be combined, but in a group of closely related yet strongly diversified plants, it seems preferable to narrow the limits. And if, as we deem justified, the two tribes *Manilkareae* and *Mimusopeae* should be distinguished as such, we cannot help keeping the two main genera apart as well. The subdivision is primarily typological, a method which was introduced in the splendid papers of BAILLON and DUBARD. In both tribes homologous variations occur, such as genera with and such without albumen, with basal and with ventral seed-scar, with laciniate and with entire appendages, with Mimusopoid and with Manilkaroid staminodes, etc.

2. An unusually large scar is found in *Mimusops Letestui* LEC. and in *Mimusops ? congolensis* DE WILD., an exceptionally small one in *Manilkara Eickii* (ENGL.) H. J. LAM [1]), *M. Bojeri* (A. DC.) H. J. LAM [1]) and *M. dissecta* (L. f.) DUB. It is obvious that in this subfamily — as in others — BAEHNI's *Pleurotraumae* and *Basitraumae* meet (CH. BAEHNI, Candollea 7, 1938, 504).

3. The character of sclereids in the leaves was first mentioned by LECOMTE. It needs thorough examination in most of the species.

The other genera of the subfamily, as accepted by me, represent variations on these types, forming the tribes of the *Manilkareae* and of the *Mimusopeae* respectively. Of these the *Manilkareae* display the greatest diversity. In addition, *Manilkara* as a genus seems to be more variable than *Mimusops*, whilst it also covers by far the most exten-

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[1]) Cf. Appendix.

sive area. I am therefore inclined to consider the trimerous type the comparatively most primitive one. The difference between the two as to this point is, however, very slight. Both types show certain connections with the *Madhucoideae* (cyclical but without staminodes) as well as with the acyclical 5-merous *Sideroxyloideae*, as regards the latter connection, the *Manilkareae* through *Lecomtedoxa-Lemonniera*, the *Mimusopeae* through *Butyrospermum*. As, moreover, transitional forms are known to link the trimerous and the tetramerous type, it may be suggested that either they have sprung from common ancestors or at any rate represent remarkably convergent types.

It must be emphasized here, that my knowledge of these genera is mostly based upon literature except insofar as the Far-Eastern species are concerned. It is therefore very well possible that on closer investigation another arrangement of the species into genera will prove to be more satisfactory. For our present purpose, however, viz. to get an insight into the potentialities and the tendencies to be found in this subfamily, the knowledge thus obtained seemed sufficient and the delimitation of the genera given here should be considered a working scheme rather than a suggestion to be accepted. The genera are (alphabetical order):

Manilkareae: **Achras** L. (3 spec. trop. America) — **Faucherea** H. Lec. (4 spec. Madagascar) — **Labourdonnaisia** Boj. (2 or more spec. Madagascar and Mascarene Isl., insufficiently known) — **Lecomtedoxa** Pierre (2 species W. Africa) — **Letestua** H. Lec. (1 spec. W. Africa) — **Manilkara** Adans. (incl. *Labramia* A. DC.) (± 74 spec., of which ± 25 spec. trop. America, ± 34 spec. trop. Africa, 15 spec. Far East and Pacific Islands) — **Mahea** Pierre (1 spec. S.E. Africa) — **Microappendicula** Engl. (as a section of *Manilkara*) (1 spec. W. Africa) — **Muriea** Hart. (3 spec. E. and S.E. Africa, 1 spec. Cuba and Haïti) — **Northia** Hook. f. (3 spec. Seychelles) — **Northiopsis** Kan. (1 spec. Caroline Isl. and Samoa). Total: 11 genera with ± 96 species.

Mimusopeae: **Baillonella** Pierre (incl. *Dumoria* Chev.) (4 spec. W. Africa) — **Butyrospermum** Kotschy (2 spec. W. and C. Africa) — **Inhambanella** Engl. (as a section of *Mimusops*; insufficiently known) (1 spec. S.E. Africa) — **Mimusops** L. (incl. *Imbricaria* Commers.) (about 57 spec. Africa, 1 spec. Far-East to W. Pacific) — **Vitellariopsis** Baill. (1 spec. E. Africa; insufficiently known). Total: 5 genera with ± 66 species.

The grand total is 16 genera with 162 species. Of these 14 genera

with 116 species occur in the African region (11 genera and all species endemic); America possesses 3 genera with 29 species (1 genus and all species endemic), the Far-East 3 genera with 17 species (1 monotypic genus very closely related to *Manilkara* and all species endemic). Only one genus, *Manilkara*, is pantropical, two others are found in two continents, viz. *Mimusops* (mostly Africa and 1 species in the Far-East) and *Muriea* (3 spec. E. Afr., 1 spec. Cuba and Haïti). The centre of the whole group is therefore indisputably the African region.

Table I (see page 350) gives a survey of the principal discriminating characters of the genera mentioned.

In the *Manilkareae* a most striking feature is the tendency of the reduction of both dorsal appendages and staminodes (if this should be called a reduction at all). Both reductions are, generally speaking, independent from one another. For instance, staminodes are small to very small in *Faucherea*, *Northiopsis* and *Northia*, wanting in *Muriea*, *Letestua*, *Labourdonnaisia* and occasionally *Manilkara*. The petal-appendages, on the other hand, are reduced in size or number in *Lecomtedoxa*, *Microappendicula* and *Labourdonnaisia*, very small or vanishing in *Mahea*, *Northia* and in certain Far-Eastern *Manilkara*-species and entirely lacking in *Achras*, *Faucherea* and *Northiopsis*. In both cases the relation with the other *Manilkareae* is proved beyond doubt by many characters such as the number of flower parts, the type of flower and nervation, the leaf-anatomy, the general habit, etc. Yet the lacking of the dorsal appendages have led the older investigators astray, as it induced Engler and Dubard to insert *Achras* in the *Sideroxylinae*, whilst this genus typologically undoubtedly is a member of the *Manilkara*-group (the insertion of *Butyrospermum* in the *Mimusopeae* is, on the other hand, doubtful), not less than *Faucherea* and *Northiopsis*, whose true nature was correctly interpreted from the beginning.

Particularly in regard to these three genera, *Achras* in Tropical America, *Faucherea* in Madagascar and *Northiopsis* in the Western Pacific, an interesting problem is arising both in the field of evolutionary development and in that of nomenclature. All are closely allied to the circumtropic *Manilkara*, whose area includes those of the small genera which have probably originated from it. In brief, we may point out the relations in the following way:

1. The American *Manilkara* have their appendages mostly as long as, or somewhat longer or shorter than the petals; in a few

TABLE I.

Genus	Sepals	Petals	Dorsal (lateral) appendages	Stamens	Staminodes	Carpels	Albumen	Scar on the seed [1])	Testa [2])
Manilkareae									
Lecomtedoxa	2(-1)+3-2	5-4(-3)	[5-4(-3)]×(2-1)	5-4(-3)	5-4(-3)	5	(+)	4	2-3
Manilkara (cf. p. 346)	3+3	6	6×2 (mostly entire)	6	6 (mostly dentate)	15-6	+	(2-)3	(3-)2(-1)
Muriea	3+3	6	6×2	6+6	—	6	+	5	2?
Letestua	3+3	18-12	(18-12)×2	18-12	—	18	+	4	2
Northia	3+3	6	6×2, small and dentate or none	6	very small and scale-like	6	—	5	1
Micro-appendicula	3+3	6	6 alt. pet.	6	6 (type of Mimusops)	6-5	?	3 or 4? (on acc. of ov.)	?
Mahea	3+3	6	none or (6-0)×2 very small	none (♀ flowers)	6+6 (subulate)	6	?	3 or 4? (on acc. of ov.)	?
Achras	3+3	6	—	6	6 (petaloid, dentic.)	12-7	+	4	2
Faucherea	3+3	6	—	6	6, sometimes one or two with a small anther (denticul. or subentire)	7-6	+	3	2
Northiopsis	3+3	6	—	6	6 (subulate or bifid, small)	6	+	3	1-2
Labourdonnaisia	3+3 or 4+4	6 or 8	12-6 or 16-8	10-17	—	6 or 8	+	1	1-2?
Mimusopeae									
Butyrospermum	4(-5) +4(-5)	8-10	none	8-10	8-10 (denticul.)	8-10	—	(4)-5	2
Mimusops (cf. p. 346)	4+4	8	8×2 (entire or 2-7-fid)	8	8 (entire)	8	+	2(-3)	2
Baillonella	4+4	8	8×2 (entire)	8	8 (entire)	8	—	5-6	1
Inhambanella	4+4	?	?	?	?	?	—	4-5	2
Vitellariopsis	4+4	8	8×2 (small)	8	8 (entire)	8	—	5	2

[1]) Scar: 1. large, basal; 2. small, circular, basal or basiventral; 3. basiventral (lower half of seed), elongate, narrow to broad; 4. long and narrow, occupying the whole ventral side of the seed; 5. occupying about $^1/_2$, and 6. more than $^1/_2$ of the surface of the seed.

[2]) Testa: 1. very thick and bony; 2. thick or hard, crustaceous; 3. thin or soft.

cases they are $^2/_3$ or $^1/_2$ as long (*M. bahamensis* [J. G. BAKER] H. J. LAM & B. MEEUSE, nov. comb. [1]) and *M. Sideroxylon* [PIERRE] DUB. respectively); they are mostly entire or sometimes bifid. The corolla-tube is relatively long, about $^1/_2$—$^1/_3$ of the total length of the corolla (except in *M. Riedleana* [PIERRE] DUB. and in *M. nitida* [URB.] DUB.); the staminodes are ovate- or oblong-lanceolate or subulate, dentate or bifid. I do not know of any species possessing a glabrous annular disc around the base of the ovary.

There are no transitions towards *Achras*, where the appendages are wanting. The other flower and vegetative characters are entirely within the range of the American *Manilkara* and there is no disc, but the staminodes are petaloid, the fruit are large and fleshy and the seeds flattened and with a long and narrow ventral scar.

2. The African (continental and insular) *Manilkara* have their appendages as long as or slightly shorter than the petals; they are entire or 2—7-fid. The corolla-tube is short, about $^1/_6$—$^1/_4$ (—$^1/_3$) of the total length of the corolla; the staminodes are ovate-triangular, subulate, bifid or trifid. A glabrous annular disc adnate to the base of the ovary is known in some species, viz. in *M. densiflora* (ENGL.) H. J. LAM, nov. comb. [1]), and in *M. Schweinfurthii* (ENGL.) DUB. The scar on the seed is apparently mostly of the usual type, but in *M. Eickii* (ENGL.) H. J. LAM, nov. comb. [1]) and in *M. Bojeri* (A. DC.) H. J. LAM, nov. comb. [1]) it is small and circular as in *Mimusops*.

There are no transitions towards *Faucherea*, in which the appendages are wanting, whilst the staminodes are conspicuous but often small (and sometimes with small anthers). There are no other essential differences from the African *Manilkara* but the flowers are exceptionally small (corolla 0.13—0.3 cm). None of the species possesses, apparently, a disc.

It may be recalled here that *Northia* from the Seychelles, shows a strong reduction of both appendages and staminodes. As has been mentioned above, this genus is, however, quite apart, among other features, by its long corolla-tube, its enormous seed-scar, its very thick testa and its lack of albumen.

3. The Far-Eastern *Manilkara* are partly of the same type as the American and African ones, partly they show, besides other variations, homologous to those in the American and African species, reductions to various degrees of both appendages and staminodes. In

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[1]) Cf. Appendix.

some species (*M. Kauki, dissecta, Smithiana* and *kanosiensis*) there is a glabrous adnate disc, and in 1 species (*M. dissecta*) the scar on the seed is of the *Mimusops*-type, in another (*M. fasciculata*) it is large and oval. This character, however, is still insufficiently known in several species.

As to the reductions of appendages and staminodes, *Table II* (see page 353) may give further information together with some other data. The incompletely known species have been left out.

As appears from this statement the general proportion of the appendages to the petals gradually decrease from the continent eastward; only *M. dissecta* (W. Pacific) has a more normal proportion. In *M. fasciculata* the appendages are very scanty, reason why this species was formerly (erroneously) included in *Northia*, the more so as the equally minute staminodes are sometimes wanting.

These conditions would undoubtedly make us insert *Northiopsis Hoshinoi* in *Manilkara*, if not the character of the wanting appendages was, in the case of *Faucherea* (and to a lesser degree also of *Achras*) a justified criterion to keep those genera apart.

The problem is quite characteristical for the particularly reticulate taxonomy of this natural order. The present case presents one of those examples of convergent evolution, the Sapothaceae are so well provided with. The reduction of the petal-appendages has apparently independently occurred in the three regions of the *Manilkara*-area, Tropical America, the African region and the Far-East. In the present case the evolutionary phase extant greatly hampers a satisfactory subdivision by its gradual and diversified appearance. In those species, in which the reduction has reached a stage, which may, morphologically speaking, be called the loss of a character, it has induced the establishment of such genera as *Achras, Faucherea* and *Northiopsis* and it may be asked whether it would be justified to combine those three genera with identical floral diagrams into one single tritopically evolved genus.

We have hesitated a long time before taking a decision. Taxonomically speaking, the combination of at least *Faucherea* and *Northiopsis* (*Achras* being well distinguished by its fruit and seed characters) seemed logical enough. However, whilst *Faucherea* is well apart from the African *Manilkara*-species, *Northiopsis* is connected by a series of gradual transitions with the Far-Eastern ones. Moreover, it shows, in its vegetative characters, a closer relation to such American species as *Manilkara bidentata* (A. DC.) Chev., *M. Sidero-*

TABLE II (dimensions in cm).

	Distrib.	Calyx	Corolla			Staminodes	Proportion Append. Petals
			tube	petals	appendages		
Manilkara							
hexandra	Asia Cont.	0.4–0.45	0.1	0.3–0.35×0.1	0.35–0.4×0.1	0.25 (bifid)	> 1
Roxburghiana	India	0.8–0.9	0.3	0.7×0.15	0.7×0.1	0.15×0.1 (dentic.)	1
Kauki	Asia to Austr.	0.6–0.75	0.15–0.3	0.45–0.7×0.1–0.25	0.45–0.7×0.1–0.25	0.35–0.5×0.15–0.3 (denticulate)	1
udoido	Carol. Is.	0.5	0.1–0.2	0.35–0.42×0.12–0.15	0.3–0.35×0.1–0.15	0.1–0.2×0.1–0.15 (dentate)	$^1/_5$
dissecta	W. Pac.	0.5–0.7	0.1	0.5×0.15	0.4×0.1	0.1–0.2×0.06–0.1 (dentate)	$^4/_5$
fasciculata	N. Guinea, Kai	0.4	0.2	0.5–0.6×0.1	0.4×0.1	0.2–0.3 (filiform) or *none*	$^3/_4$
celebica	C. & N. Cel.	0.9–1	0.08	0.7×0.3	0.45–0.5×0.15	0.25–0.4×0.1–0.15 (dentate)	$^2/_3$
Smithiana	Fiji	0.85–1.0	0.3	0.9×0.25	0.65–0.7×0.25	0.4–0.45×0.25 (denticulate)	$^2/_3$
Merrilliana	Phil., Cel., Moluccas	0.5 (bud)	short	x	$^2/_3$ x	$^1/_3$ x (dentate)	$^2/_3$
samoensis	Samoa	1.1–1.4	0.2	1.1–1.3×0.2	0.75×0.2	0.3–0.6×0.2–0.3 (denticulate)	$^1/_3$
kanosiensis	Papua	1.0	0.2	0.65×0.2–0.25	0.35×0.1	0.3×0.15 (dentic.)	$>{}^1/_4$
vitiensis	Fiji	1.1–1.2	0.15–0.2	1.0–1.2×0.2–0.25	0.25×0.1	0.2×0.2 (dentic.) or *none*	$^1/_4$–$^1/_5$
Northiopsis							
Hoshinoi	Carol., Samoa	1.5–1.7	0.2–0.4	1.8×0.5	*none*	0.2–0.4×0.1 (lanc., entire or bifid)	–

xylon (PIERRE) DUB. and *M. nitida* (URB.) DUB. than to the Madagascarian *Faucherea*. Under these conditions it is extremely difficult to find a logical taxonomical position and a logical name for the single species of *Northiopsis*. If *Faucherea* and *Northiopsis* would be combined, the incongruity arises of an illogically discontinuous generic area, as well as of the circumstance that one of the geographically isolated species would be much closer related to *Manilkara* than to the other species of its genus. If *Manilkara* would be chosen to harbour it, there is no reason to leave *Faucherea* out; and if *Faucherea*, well distinguished from the African *Manilkara* would be inserted, it is the Liberty Hall here and many other smaller genera would claim admittance to a very broadly conceived *Manilkara*, which would undoubtedly need a subdivision into sections. In this mess we have felt, and still feel at a loss. Probably only a botanist, living some ten or hundred thousands of years later (if botanists still are roaming then) may be more lucky (or not) when put face to face with this group of plants. Under these conditions we preferred to leave things mostly as they were, to accept the statement of an unaccomplished evolution and to choose any of the arbitrary ways out of the labyrinth, i. e. to maintain KANEHIRA's *Northiopsis* until better times arrive.

APPENDIX

List of new combinations, other than those, mentioned in the systematic part.

MANILKARA

M. Adolfo-Friederici (ENGL. & KRAUSE) H. J. LAM, nov. comb. — *Mimusops Adolfo-Friederici* ENGL. & KRAUSE, ENGL. Bot. Jahrb. 49, 1913, 392 — Lower Congo.

M. altissima (ENGL.) H. J. LAM, nov. comb. — *Mimusops altissima* ENGL., Mon. Afr. Pfl. Fam. u. Gatt. VIII, 1904, 55 — E. Africa.

M. bahamensis (J. G. BAKER) H. J. LAM & B. MEEUSE, nov. comb. — *Achras bahamensis* J. G. BAKER in HOOK., Ic. Pl. 18, 1888, t. 1795 — *Manilkara parvifolia* (not of H. J. LAM, 1925) (RADLK.)

DUB., Ann. Mus. Col. Mars. 23, 1915, 16 — *Mimusops parvifolia* (not of R. BR., 1810 nor of KURZ, 1877) RADLK., Sitz. Ber. Ak. Wiss. München 12, 1882, 344 and in PIERRE & URBAN in URBAN, Symb. Ant. 5, 1904, 171 — *Sloanea emarginata* L., Sp. Pl. Ed. I, 1753, 512 — *Mimusops emarginata* (L.) BRITTON, Torreya 11, 1911, 128; H. J. LAM, B. P. Bish. Mus. Bull. 141, 1936, 163 — *Manilkara emarginata* (not of H. J. LAM, 1925) (L.) BRITTON & P. WILSON, Sc. Surv. Porto Rico & Virg. Isl. 6, 1926, 366 — Bahamas.

M. Bequaertii (DE WILD.) H. J. LAM, nov. comb. — *Mimusops Bequaerti* DE WILD., Rev. Zool. Afr. III, 1919, 26 and in Pl. Bequaert. III, 1925, 147 — Congo.

M. Bojeri (A. DC.) H. J. LAM, nov. comb. — *Labramia Bojeri* A. DC., Prodr. VIII, 1844, 672; DUBARD, Ann. Mus. Col. Mars. 23, 1915, 58 — Madagascar.

M. Casteelsii (DE WILD.) H. J. LAM, nov. comb. — *Mimusops Casteelsi* DE WILD., Pl. Bequaert. III, 1925, 152 — Congo.

M. Dawei (STAPF) H. J. LAM, nov. comb. — *Mimusops Dawei* STAPF, Journ. Linn. Soc. 37, 1906, 523 — Uganda.

M. densiflora (ENGL.) H. J. LAM, nov. comb. — *Mimusops densiflora* ENGL., Pflanzenw. Ost-Afr., C, 1895, 307 and l. c. 1904, 63 — E. Africa: Zanzibar coast region.

M. Doeringii (ENGL. & KRAUSE) H. J. LAM, nov. comb. — *Mimusops Doeringii* ENGL. & KRAUSE, ENGL. Bot. Jahrb. 49, 1913, 391 — Togo.

M. dukensis (ENGL. & KRAUSE) H. J. LAM, nov. comb. — *Mimusops dukensis* ENGL. & KRAUSE, l. c. 1913, 391 — Cameroon.

M. Eickii (ENGL.) H. J. LAM, nov. comb. — *Mimusops Eickii* ENGL., Mon. Afr. Pfl. Fam. u. Gatt. VIII, 1904, 60 — E. Africa: W. Usambara.

M. excisa (URB.) H. J. LAM, nov. comb. — *Mimusops excisa* URB., Symb. Ant. V, 1908, 459 — Jamaica.

M. Fischeri (ENGL.) H. J. LAM, nov. comb. — *Sideroxylon Fischeri* ENGL., Pflanzenw. Ost-Afr., C, 1895, 307 — *Mimusops Fischeri* (ENGL.) ENGL., l. c. 1904, 64 — E. Africa: Massai region.

M. frondosa (HIERN) H. J. LAM, nov. comb. — *Mimusops frondosa* HIERN, Catal. Afr. Pl. Welwitsch III, 1898, 645; ENGLER, l. c., 1904, 56 — W. Africa: Angola.

M. Guillotii (HOCHR.) H. J. LAM, nov. comb. — *Mimusops Guillotii* HOCHR., Ann. Cons. et Jard. Bot. Genève XI—XII, 1908, 83 — E. Madagascar.

M. ilendensis (ENGL.) H. J. LAM, nov. comb. — *Mimusops ilendensis* ENGL., l. c. 1913, 393 — Cameroon.

M. kribensis (ENGL.) H. J. LAM, nov. comb. — *Mimusops kribensis* ENGL., l. c. 1913, 393 — Cameroon.

M. Macaulayae (HUTCH. & CORB.) H. J. LAM, nov. comb. — *Mimusops Macaulayae* HUTCH. & CORB., Kew Bull. 1920, 329 — N. Rhodesia.

M. Menyhartii (ENGL.) H. J. LAM, nov. comb. — *Mimusops Menyhartii* ENGL., l. c. 1904, 63 — S.E. Africa: Zambezi region.

M. propinqua (S. MOORE) H. J. LAM, nov. comb. — *Mimusops propinqua* S. MOORE, Journ. Linn. Soc. 37, 1905, 177 — C. Africa.

M. rufula (MIQ.) H. J. LAM, nov. comb. — *Mimusops rufula* MIQ. in MART., Fl. bras. 7, 1863, 44 — Brazil.

M. Salzmannii (A. DC.) H. J. LAM, nov. comb. — *Mimusops Salzmannii* in DC., Prodr. VIII, 1844, 205 — Brazil.

M. Seretii (DE WILD.) H. J. LAM, nov. comb. — *Mimusops Sereti* DE WILD., Fedde's Repert. 13, 1914, 377 — Congo.

M. spiculosa (HUTCH. & CORB.) H. J. LAM, nov. comb. — *Mimusops spiculosa* HUTCH. & CORB., l. c. 1920, 331 — Rhodesia.

M. umbraculigera (HUTCH. & CORB.) H. J. LAM, nov. comb. — *Mimusops umbraculigera* HUTCH. & CORB., l. c. 1920, 331 — S. Rhodesia.

MIMUSOPS

M. Lecomtei H. J. LAM, nov. nom. — *Mimusops silvestris* LEC., Bull. Mus. Hist. Nat. Par. 28, 1922, 88 (not *M. sylvestris* S. MOORE 1911).

Index

Synonyms in italics; an asterisk denotes a new species.

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THE GENUS PODOCARPUS IN THE NETHERLANDS INDIES

by

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(Issued July 11th, 1941).

When delimiting the area to be dealt with in this paper, it appeared, on the one hand, desirable to include some adjacent regions, such as the Malay Peninsula, North Borneo, Eastern New Guinea, the Bismarck Archipelago, and the Solomon Islands; on the other hand the war made it impossible to obtain herbarium materials from several Herbaria in Europe and the Tropics, and to elaborate the genus *Podocarpus* for the whole of Malaysia. Especially the Philippine Islands could not be taken into consideration, but the few materials I had the opportunity of examining have been included. I believe this treatment of the genus *Podocarpus* is rather complete for the Netherlands Indies proper.

The specimens which I could examine in Groningen were lent by the Directors of the following Herbaria:

(B) = the Herbarium of the Botanic Garden, Buitenzorg.
(BD) = the Herbarium of the Botanical Museum, Berlin-Dahlem.
(G) = the Herbarium of the University, Groningen.
(L) = the National Herbarium (Rijksherbarium), Leiden.
(Pa) = the Herbarium of the Sugar Experiment Station, Pasoeroean.
(S) = the Herbarium of the Botanic Garden, Singapore.
(U) = the Herbarium of the University, Utrecht.
(W) = the Herbarium of the University College of Agriculture, Wageningen.

To the Directors and Keepers of these Institutions I render my best thanks for their kindness in forwarding me the specimens.

Besides the above mentioned letters for indicating the Herbaria in which the specimens are preserved, the following abbreviations have often been used in the distribution lists:

B. = Boekit, Bukit = mountain, hill.
G. = Goenoeng, Gunong = mountain.
P. = Poeloe, Poelau, Pulu, Pulau = island.
S. = Soengi, Soengei, Soengai, Sungei = river.
f = female specimen.
m = male specimen.
s = sterile specimen.

PODOCARPUS L'Héritier.

Nageia Gaertner, De fruct. et sem. pl. (1788) 191 p.p.; Kuntze, Rev. Gen. Plant., 2 (1891) 798; Baillon, Hist. pl., 12 (1892) 40. — *Podocarpus* [1]) (non Labillardière 1806) l'Héritier, ex Persoon, Synops., 2 (1807) 580, nomen conservandum; Blume, Enum. pl. Javae, 1 (1827) 88; Bennett, in Horsfield, Pl. Jav. rar. (1838) 35; Endlicher, Syn. Conif. (1847) 206; Blume, Rumphia, 3 (1847) 212; Miquel, Fl. Ind. Bat., II, 6 (1859) 1071; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 377; De Boer, Conif. Arch. Ind. (1866) 12; De Kirwan, Conif., 2 (1868) 223; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 368, 507; Miquel, in Siebold & Zuccarini, Fl. Jap., 2 (1870) 68; Bentham, Fl. austr., 6 (1873) 246; Bentham & Hooker f., Gen. pl., III, 1 (1880) 423, 434; Vidal y Soler, Fl. For. Fil. (1883) 277; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1887) 104; Hooker f., Fl. Br. Ind., V, 3 (1888) 649; Beissner, Nadelholzk. (1891) 16, 193; Kent, in Veitch's Man. Conif. (1900) 147; Bailey, Queensl. Fl., 5 (1902) 1497; Pilger, in Engl., Pflanzenr., IV, 5 (1903) 54; Koorders & Valeton, Bijdr. Booms. Java, 10 (1904) 259; Brandis, Indian Trees (1906) 695; Pilger, in Engl. & Pr., Nat. Pflanzenfam., Nachtr. III (1908) 4; Baker & Smith, Res. Pin. Austr. (1910) 433; Koorders, Exkursionsfl. Java, 1 (1911) 63; Ridley, in Journ. Straits Br. Roy. As. Soc., 60 (1911) 56; Foxworthy, in Philipp. Journ. Sci., 6 (1911) 155; Hallier, in Elbert, Sunda-Exped., 2 (1912) 295, 302; Koorders, Fl. Tjibodas, I, 2 (1922) 2; Ridley, Fl. Mal. Pen., 5 (1925) 280; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 240; Fitschen, Nadelholzk. (1930) 7, 61; Florin, in Kungl. Sv. Vet. Akad. Handl., 10, 1 (1931) 262, 285; Hickel, in Lecomte, Fl. gén. Indo-Chine, V, 10 (1931) 1066. — *Podocarpus* & *Nageia* Carrière, Traité gén. Conif., II, ed. 2 (1867) 643; Gordon, Pinetum, ed. 2 (1875) 326.

Dioecious, or very rarely monoecious. Male flowers cylindrical, rarely (*Dacrycarpus*) terminal on short lateral twigs, usually solitary or in bundles in the leaf axils sessile or on short common peduncles and each flower with sterile bud scales around its base, or sometimes bundled at the apex of small twigs, or in compound inflorescences, or rarely spicate; stamens usually imbricate, always with 2 thecae dehiscent

[1]) I accept *Podocarpus* as a female noun, as it was considered so by l'Héritier and many subsequent authors. Later authors often take it as a male noun, but there is no real grammatical argument for this. Cfr. Danser, in Blumea, 1 (1935) 300—303.

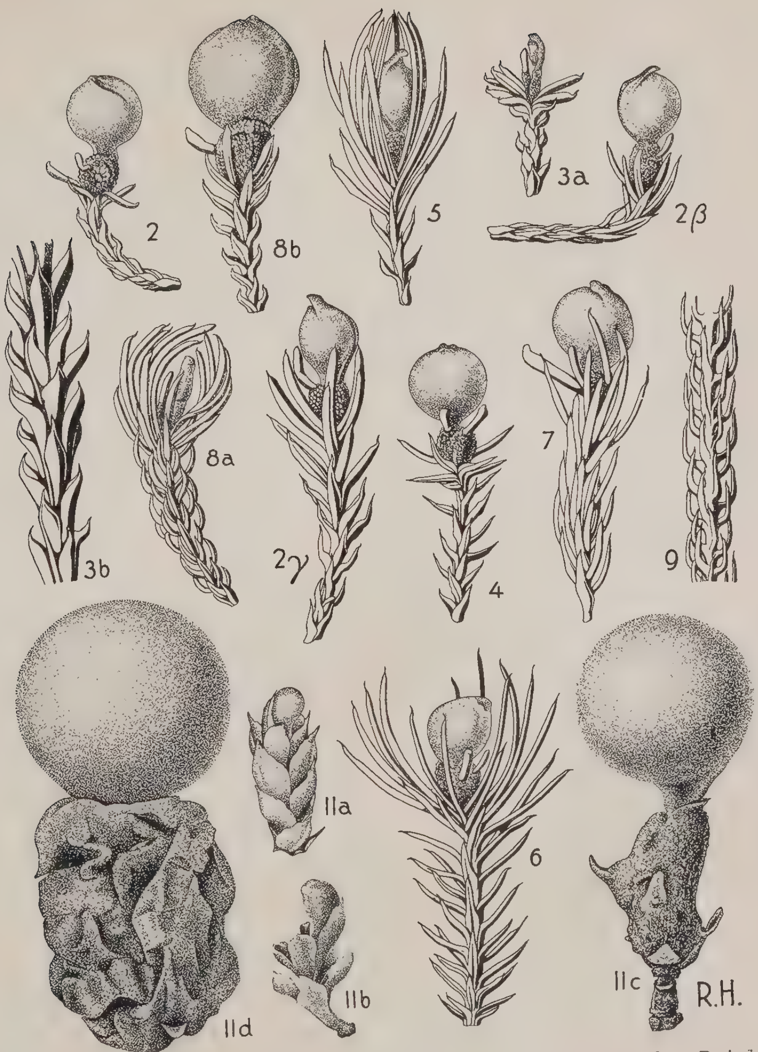

Plate IV. Fig. 2: *Podocarpus imbricata*, fruit (*Boerlage* s. n.); 2β: *P. imbricata* var. *curvula*, fruit (*Junghuhn* s. n.); 2γ: *P. imbricata* var. *kinabaluensis*, fruit (*Clemens* 29914); 3a: *P. papuana*, female flower (*Gibbs* 5540); 3b: *P. papuana*, twig fragment (*Gibbs* 5540); 4: *P. Steupii*, fruit (*Boschpr.* b.b. 22857); 5. *P. Cumingii*, fruit (*Elmer* 11684); 6: *P. cincta*, fruit (*Clemens* 5562); 7: *P. dacrydiifolia*, fruit (*Boschpr.* b.b. 13633); 8a: *P. compacta*, female flower (*Pulle* 964); 8b: *P. compacta*, fruit (*Brass* 4284); 9: *P. leptophylla*, twig fragment (*De Kock* 39; 11a—d: *P. Motleyi*; 11a and b: female flowers (*Corner* 21341), 11c: unripe fruit (*Boschpr.* 12T. 1P. 185), 11d: ripe fruit, shrivelled (*For. Dep.* Fed. Mal. St. 16568). All figs. 2 ×.

with a slit, the filament nearly none, the apiculus small; pollen grains with 2 or 3 air-bladders. Female flowers usually single in the leaf axils, sometimes (*Dacrycarpus*) terminal on short lateral twigs, usually with a receptacle composed of 2 or more fleshy scales or leaf-bases, of which 1 or rarely 2 are fertile or sometimes (*Stachycarpus*) spike-shaped with 2—8 remote carpids, or with 1—2 ovules on the apices of short, non-thickened twigs; carpids always with a single ovule; ovules usually much overtopping the carpid, sometimes (*Dacrycarpus*) longitudinally connate with the carpid, always with a single integument, which is entirely connate with a cup-shaped, incurved excrescence of the carpid, the "ephimatium" [1]; micropyle directed towards the base of the carpid; seed rather large, globose or elliptical, sometimes shortly apiculate; testa with a fleshy or coriaceous outer layer, and a hard inner layer; cotyledons 2. — Trees or shrubs. Leaves sometimes (*Dacrycarpus*) scale-like or subulate, usually linear or lanceolate to ovate, scattered or more rarely (*Nageia, Polypodiopsis*) opposite, usually with a single rib, rarely (*Nageia*) with numerous longitudinal nerves.

General remarks.

The remarks on the genus *Podocarpus* following here have for the greater part already been given by Pilger in his monographic treatment of the *Taxaceae* and *Podocarpaceae* in Das Pflanzenreich, IV, 5 (1903), and Die natürlichen Pflanzenfamilien, ed. 2, XIII (1926). Here, however, they have been worked out somewhat more in detail for the species indigenous in the area, and several completions have been added. In the morphological terminology and nomenclature I followed Pilger almost entirely. Also the subdivision of *Podocarpus* in subgenera and sections has mainly been taken from this author, though I doubt whether the subdivision into two subgenera is right. Perhaps we had better not distinguish any subgenera, but only 6 equivalent groups, which we might call either subgenera or sections.

All *Podocarpi* are woody plants, but the dimensions may vary widely. *P. imbricata* and *P. amara* belong to the tallest trees of the tropics, sometimes reaching a height of 60 m and elevating their crowns to above the canopy of the forest. Most species are tall or moderate-sized trees, some of them up to 40 m tall, such as *P. dacrydiifolia, P. neriifolia, P. Blumei, P. Motleyi*, in other species less tall, such as *P. polystachya, P. Pilgeri, P. glauca*, and *P. thevetiaefolia*. One

[1]) See p. 367, footnote.

species, *P. brevifolia*, is only known as a shrub. Several *Podocarpi*, however, take this form when growing at high elevations, such as *P. imbricata* var. *curvula* and var. *kinabaluensis*, *P. compacta*, *P. neriifolia*, *P. Pilgeri*, *P. Brassii*, and in extreme cases these shrubs are less than 2 m high or even procumbent. The tall trees usually have a straight, columnal bole with branches usually in the upper portion only, whereas the smaller trees and the shrubs may be branched almost from the base.

The structure of the stem of all *Podocarpi* is monopodial, the main stems always continuing their growth from the terminal buds. The following modes of ramification may be distinguished:

1. In the section *Eupodocarpus* and in *P. amara* (*Stachycarpus*) the ramifications originate from the axils of the youngest leaves just below the terminal bud, thus causing the lateral twigs to be crowded nearly to whorls (up to 8 together) at the ends of the vegetation periods. Beside these, we now and then (e. g. in *P. thevetiaefolia*) meet with very short, few-leaved short side-twigs scattered over the vegetation periods.

2. In the section *Dacrycarpus* the lateral twigs are alternatingly bifarious, whereas the leaves are scattered (spirally arranged). Moreover there is a twig dimorphism, especially in seedlings and young sterile plants: the leaves of the lateral twigs are not scale-like or subulate as in the main twigs, but linear and turned into one plane and seemingly bifarious, this giving the twigs a pinnate appearance. These pinnate twigs are usually unbranched, rarely branched, and have a limited growth. Also the flower-bearing lateral twigs have a limited growth.

3. In the sections *Nageia* and *Polypodiopsis* the twigs are opposite and probably always decussate. In *Polypodiopsis* there is, moreover, a peculiar twig dimorphism, the main twigs only bearing scale-like leaves, the youngest lateral twigs well-developed leaves, turned into one plane in a particular manner (see below).

The number of vegetation periods bearing leaves at a certain moment usually varies from 1 to 3, but may amount to 5 in exposed localities at high elevations. In the latter case, the vegetation periods are very short and crowded, e. g. in *P. brevifolia* and *P. Brassii*, and the bud scales are persistent for several vegetation periods, whereas they usually fall off as soon as the twigs grow out.

The shape of the terminal bud which, except in the section *Dacrycarpus*, is always enclosed by adpressed scales, is often constant,

and furnishes valuable specific characters, varying from globose to narrowly conical. In some species, however, the length of the bud scales may vary widely, as in *P. neriifolia,* where the scales are sometimes ovate, acute, 2.5 mm long, sometimes subulate-acuminate, gradually attenuate, up to 30 mm long. In the section *Dacrycarpus* bud scales are entirely absent.

The l e a v e s are very different as regards their shape and position, in different sections. In *Dacrycarpus* they are spirally arranged and subulate, or scale-like and densely imbricate, often entirely appressed. Especially in seedlings and young sterile plants there are, moreover, lateral twigs which in their basal part bear scale-like to subulate leaves, but for the rest linear, laterally flattened ones, which are directed into one plane and apparently bifarious. Between the leaves of the pinnately-leaved twigs and the scale-like or subulate leaves we find all kind of intermediary forms, especially such as are laterally flattened and quinquefarious. The linear leaves bear on both surfaces and at both sides of the midrib a narrow stripe with 1—3 rows of stomata.

In *Eupodocarpus* and *Stachycarpus* the leaves are scattered, and by their strongly flattened lamina similar to dicotyledonous leaves. Usually they are more or less spreading, sometimes deflexed, as in *P. deflexa*, in forms of high elevations adpressed to the twigs, as in *P. brevifolia, P. glauca, P. Brassii,* and mountain forms of *P. neriifolia* and *P. Pilgeri*. The shape of the leaves varies from linear or lanceolate to oblong; in *P. Rumphii* and *P. deflexa* they may be over 30 cm long, in *P. glauca* and *P. Brassii* only 10—22 mm. Towards the base they are always contracted into a very short petiole. The mode in which they are attenuate towards the apex often furnishes valuable distinctive characters; attention must, however, be paid to the fact, that the leaves of young plants are often different from those of adult plants of the same species, *viz.*, acuminate or even caudate-acuminate towards the tip. Another valuable distinctive character is in the midrib, which is usually prominent, but sometimes flat or even slightly impressed on the upper side, and sometimes characteristically shallowly grooved on the lower side. In *Eupodocarpus* and *Stachycarpus* stomata are only found on the underside of the leaves, in rather parallel rows.

The leaves of *Polypodiopsis* are decussate, but they are spread in one plane in a peculiar way. In the first place the internodes between the pairs of leaves are alternatingly twisted to the left and the right, so that the pairs of leaves become apparently superposed. Moreover,

all leaf bases show a torsion in the same direction [1]), so that the flattenings of all leaves come in one plane with the twig and with each other. As a result of the two torsions the leafy twigs have a pinnate appearance, and in the herbarium all leaves of the left side of the twig turn their morphological under side, all leaves on the right side the morphological upper side to the observer. Pilger was the first to point to these peculiarities in his description of *Podocarpus Rospigliosii* (Notizbl. Berlin-Dahlem, VIII, 1923, 273), and he drew attention to the resemblance of this species with *P. vitiensis*, but his description of the phenomenon is incomplete. Florin later (Kungl. Svensk. Vet. Akad. Handl., X, 1, 1931, 191, and XIX, 2, 1940, 8) gave a description and explication in full with photographs and diagrams of the phenomenon in *P. Rospigliosii, P. vitiensis* and *P. minor*, and in his last named paper he described the same for the fossil *P. araucoensis* from South Chile.

In the section *Nageia* the leaves are large, and ovate to oblong-lanceolate, and likewise decussate and turned into one plane, but not in the same way in all species. According to Florin (1931, p. 274) the species of this section may be devided into two groups. The first group, including *P. Blumei, P. Motleyi* and *P. Wallichiana*, has the leaves amphistomatic and all turned to the right (as in *P. vitiensis*), whereas a fleshy receptacle is present; in the other group, including *P. nagi, P. nankoënsis* and *P. formosensis*, the leaves are hypostomatic or nearly so, and are turned in different directions, all turning their morphological upper side towards the light. These groups also have a different geographical distribution. In this respect the Indo-Chinese *P. Fleuryi*, which Florin did not examine, is doubtful, as it agrees with the one group by the absence of a fleshy receptacle, with the other group by the leaves all being turned to the right, if at least Hickel's figure in Flore Indo-Chine, V, p. 1076, is correct.

The young r o o t s of *Podocarpus* always bear nodules, probably caused by *Pseudomonas radicicola* (see Pilger 1926, l. c., p. 217). I found them in *P. imbricata, P. neriifolia*, incl. var. *polyantha*, and *P. Pilgeri*.

The f l o w e r s are nearly always dioecious, though sometimes

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[1]) Florin speaks of a torsion towards the right, whereas I should prefer to call it a torsion to the left. If we place the twig upright before us, with the apex of the leaf in question towards the observer (as is usual in morphology) the leaf turns its upper side to the left, its underside to the right.

monoecy is mentioned. It seems probable that the latter may now and then occur in species which, as a rule, are dioecious, as the same is the case in several other genera of Conifers.

The male flowers are nearly cylindrical, and are composed of an axis covered with a large number of spirally arranged imbricate stamens, with a short filament and 2 oviformous elliptical thecae opening with a slit; the connective is prolongated above the thecae into a triangular or ovate tip, the "apiculus".

In *Dacrycarpus* the male flowers are simply terminal on short lateral twigs; the leaves of these twigs gradually merge into the little different stamens.

In *Eupodocarpus* the male flowers are always axillary. They are either single in the axils, or fascicled to 2—3, or to 3—5 as in *P. polystachya*, or even to 8 as in *P. Koordersii*. Usually they are sessile, more rarely are they placed on a short common peduncle. They are surrounded at their base by a large number of sterile scales entirely enclosing the flower in the bud stage. The shape of these buds furnishes an important character for the distinction of the species.

In *Stachycarpus* (*P. amara*), the male flowers are usually placed in threes on the extremities of axillary peduncles. More rarely we meet with more compound inflorescences with a more prolongated peduncle bearing either more numerous remote flowers or several fascicles of flowers. The flowers are always placed in the axils of triangular bracts and bear a few sterile scales in their basal parts, which hardly can be distinguished from the stamens.

In *Nageia* the male flowers are single in the axils of the leaves (*P. Motleyi*), or 3—6 in the axils of triangular bracts on common peduncles, which are inserted in the leaf axils.

In *Polypodiopsis* (*P. vitiensis*) the male flowers are usually placed in the axils of decussate bracts on leaf-less twigs; rarely do we find them in the axils of normal leaves besides, apparently also on the apices of the leafy twigs (cfr. the discussion of the species).

The pollen grains of all species examined have always airbladders, usually 2, in the section *Dacrycarpus*, however, 3 in number.

Female flowers. In *P. amara*, the only Malaysian species of the subgenus *Stachycarpus*, the female flower is an axillary twig up to 5 cm long bearing 2—3 remote, small, scale-like carpids each bearing an ovule and in the basal part a few sterile scales or scars of these. In other, non-Malaysian, species of *Stachycarpus* the number of carpids may amount to 8 or be reduced to one.

In all other sections the female flower is characterised by a so-called receptacle, which in different sections may be formed in different ways. In *Eupodocarpus* the flowers are always single in the leaf axils on slender naked peduncles 1—25 mm long. Each flower is composed of two fleshy scales (Cfr. *Plate V, 19, a and b.*), of which the one is fertile, the other sterile, connate over almost the whole length and together forming the nearly cylindrical receptacle. The sterile portion, which usually is somewhat shorter than the fertile one, goes out into a short free apical mucro, whereas the fertile part has, at its apex, a free narrow margin, and bears an ovule overtopping the carpid. More rarely the receptacle is composed of 3 or 4 fleshy scales (Cfr. *Plate V, 17 ι, 14 a—c.*), and in the latter case these scales are arranged in 2 decussate pairs, the lower of which is fertile, the upper sterile. *P. salomoniensis* is only known with 4 scales; in *P. deflexa, P. neriifolia* var. *polyantha* and *P. Rumphii* a great part of the flowers have more than 2 scales, in *P. neriifolia, P. polystachya, P. Pilgeri, P. brevifolia, P. glauca,* and *P. Brassii* such flowers are rare; in the other species dealt with, female flowers are not or hardly known.

At the base of the receptacle we find in all Malaysian species two deciduous subulate, small leaves up to 6 mm long, the "foliola", decussately alternating with the scales forming the receptacle. Only once did I see in a Javan plant of *P. neriifolia* a flower, in which one of the foliola took part in the formation of the receptacle.

In the Malaysian species of *Nageia* there is also a receptacle; here, however, it does not become fleshy before the seed ripens. The flowers are placed on axillary peduncles up to 3 mm long, and are composed of 3—5 decussate pairs of small leaves nearly 3 mm long, and of which the uppermost, somewhat longer one bears an ovule (Cfr. *Plate V, 14 a—c*). Finally the axis and the basal portions of the scales form a fleshy receptacle bearing the non-fleshy apical parts of the scales on its surface. In some non-Malaysian species the receptacle does not become fleshy at all. In this section the peduncle moreover bears a few pairs of sterile, membranous, deciduous bracts.

In *Polypodiopsis* the female flowers behave, as far as known, as in the precedent section. Whether the receptacle becomes fleshy or not, is not known to me.

Whereas in all preceding sections the female flowers are always axillary, they are in the section *Dacrycarpus* terminal on short, normally leafy lateral twigs (Cfr. *Plate IV, 2—8*). The receptacle is, in this section, composed of usually 2 nearly equally long fleshy leaf-

bases with a very verruculose surface. The sterile portion bears on its top a short, cylindrical, leafy, free lamina, the fertile portion a long, erect, free carpid, which is connate with the ovule over its whole length and the extremity of which is sometimes visible on the top of the seed as a curved, free tip. The receptacle is sometimes composed of several leaf bases, which are very different in length and spirally arranged on the axis. When there are more than 2 scales, two of them are sometimes fertile, as we occasionally meet with in *P. imbricata*, *P. papuana*, *P. Steupii*, and *P. dacrydiifolia.* For the distinction of the species, the shape, length and direction of the leaves involucrating the receptacle are of great importance.

Each carpid always bears only one ovule with one integument. The ovule is, however, also involved by an excrescence of the carpid, the so-called *ephimatium* [1]), which in *Podocarpus* is entirely connate with the integument. It is always nearly ellipsoidal or globose-ellipsoidal, except in *P. amara,* where it is attenuate into a furrowed apiculus; it has the micropyle turned downward and close to the insertion on the receptacle. In most of the sections the ovule is much longer than the free margin of the receptacle, but in the section *Dacrycarpus* the ephimatium is entirely connate with the long carpid. In the young stage the limit between the ovule and the carpid is still distinct, but finally this limit disappears entirely, and only the extremity of the carpid is still visible as a slight elevation on the top of the seed. (Cfr. *Plate IV, 2—8*).

F r u i t a n d s e e d. The receptacle is always fleshy, at least finally, and when the seed ripens it is juicy. In the section *Eupodocarpus* it even becomes broad-cylindrical or globose, and thicker than the seed, and then the composing parts can no longer be distinguished (Cfr. *Plate V, 19c*). In *Nageia* the same is the case, but here only the upper scales are almost entirely taken up in the receptacle, and of the further scales the decussate apical parts remain hard and dry and are diciduous (Cfr. *Plate IV, 11d*).

In *Dacrycarpus* the receptacle remains rather small and warty, and the free apical portions of the composing scales are persistent on it in maturity (Cfr. *Plate IV, 2—8*).

What is usually called the ripe seed and the seed testa are in

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[1]) Pilger writes *epimatium.* I prefer to write *ephimatium,* in accordance with the derivation from ἐπι and ἱματιον.

reality the same parts covered with the ephimatium, or in the section *Dacrycarpus* partly with the carpid besides.

In *Eupodocarpus* the limit between the real seed and the ephimatium can hardly be distinguished anymore. In this section the seed is usually ellipsoidal or globose-ellipsoidal and nearly 10 mm, rarely up to 15 mm long. Its apparent wall is rather thin, but coriaceous or even harder.

In *Nageia* the outer layer of the seed wall is thin-coriaceous, the inner layer harder and rather bony. The seed is subglobose, and its diameter can reach 2 cm.

In *P. amara*, the only Malaysian species of *Stachycarpus*, the seed is subglobose with a small prominent apiculus; it is very large, reaching a diameter of 2.5—3 cm. Its testa is drupaceous; the inner layer, formed by the integument, is woody, very hard, and up to 2 mm thick; the outer layer, formed by the ephimatium, is very fleshy and finally juicy. It is curious, that it is exactly here that a fleshy receptacle is absent.

As has already been remarked, the so-called ripe seed of the section *Dacrycarpus* is not only formed by the ovule and the ephimatium, but by the carpid as well. The (apparent) testa is rather thin, but firmly coriaceous or bony; it has a smooth and shining surface, but is sometimes slightly uneven by resin bladders in the outer part. The seed is small, subglobose, up to 7 mm in diameter.

The ripe seed of *Podocarpus* is always filled up with a copious albumen (prothallium); the nucellus is still to be found as a thin membrane around the albumen. In the axis of the albumen we find the narrow-cylindrical embryo, with its rootlet directed towards the micropylar end of the seed, and the two cotyledons towards the opposite side.

HORIZONTAL DISTRIBUTION.

Of the 25 species occurring in the area dealt with in this paper, only one is cultivated there, and 24 are growing wild. Of these 13 have not been found outside the area, 7 have been found there and in the Philippines, one moreover in Queensland, 2 moreover in Southeastern Asia and the Fiji Islands, and one in the area and the Fiji Islands. Several species have very limited areas of distribution.

The subgenus *Stachycarpus* (see *Fig. 1*) is, in Malaysia, only represented by *P. amara*. The area of this species is extended over the whole of the Malay Archipelago, with the exception of Borneo, and reaches moreover the monsoon region of Queensland. Other species of

this subgenus have been found in Africa, South America, and Australia, including New Caledonia and New Zealand.

In the section *Dacrycarpus* (see *Fig. 2*), *P. imbricata* has a wide and continuous area of distribution. It is found in the whole Malay Archipelago, in a south-eastern direction reaching as far as the Fiji Islands, in a north-western direction as far as South China and Upper Burma. Only two species of *Dacrycarpus* are known from outside this area, viz., *P. Vieillardii* from New Caledonia and *P. dacrydioides* from New Zealand. Of the other species of this section *P. Cumingii* has a peculiar distribution, as it has been found in the Philippines and North Sumatra. Merrill, when discussing the floristic relationships of the Philippines (Enum. Phil. Fl. Pl., 4, 1926, 93), did not know any species with a distribution of that kind, and supposed that such species might always be found also in Borneo. This may be right for our species too. All other species of this section are limited to a single island.

Species of the section *Nageia* (see *Fig. 3*) are, outside the area dealt with, known in Formosa, Japan, French Indo-China, Burma and the Deccan Peninsula. Of the species occurring inside the area, *P. Blumei* is widely spread and has a distribution resembling that of *Nepenthes* and several other plants (see Van Steenis, in Bull. Jard. Bot. Buitenz., sér. 3, XIII, 3, 1934, 350, and Tijdschr. Kon. Aardr. Genootsch., sér. 2, 52, 1935, 43). The area of these plants is partly determined by the influence of the East Monsoon, and is restricted to regions with at least 30 rainy days in the driest four months of the year. The distribution of *P. Wallichiana*, which is spread in a north-western direction from Cochin-China to Assam, and South Deccan, is exactly a continuation of that of *P. Blumei*, and, since the differences between these two species are slight and inconstant (see the discussion of *P. Blumei*), it seems probable that they are geographic variations of a single species. The same may be said of *P. Fleuryi*, another closely allied species, according to the description only different from *P. Wallichiana* by a dry instead of a juicy receptacle, and occurring in Cambodia, Annam, and Tonkin.

Besides these large-leaved species there belong to the section *Nageia* a number of small-leaved ones. *P. nagi* is common in South Japan and perhaps occurs in Formosa; of this island also the closely allied *P. nankoënsis* and *P. formosensis* are known. *P. Motleyi* is spread in the lower parts of Borneo, the Malay Peninsula, and Sumatra. This accentuates once more that the lowland floras of Borneo, the Malay Peninsula and Sumatra show greater affinities to each other than to

that of Java (cfr. Van Steenis, in Bull. Jard. Bot. Buitenzorg, sér. 3, XIII, 1, 1933, 23).

Of the section *Polypodiopsis* (see *Fig. 3*), *P. vitiensis* is the only species indigenous to the area. According to Florin (1931, l. c.) *P. minor,* from New Caledonia, and *P. Rospigliosii,* from Peru, belong to the same section.

The section *Eupodocarpus* (see *Fig. 4*) is spread in south-eastern Asia incl. Japan, and the Malay Archipelago, Australia incl. New Caledonia, the Fiji Islands, New Zealand and Tasmania, moreover in South and Central America, the West Indies, South and East Africa with Madagascar. Of the Malaysian species of *Eupodocarpus, P. neriifolia* has the widest area of distribution, extending in a northern and north-western direction to Nepal and South and East China, in an eastern direction to the Fiji Islands. This area recalls that of *P. imbricata,* but is spread more to the North and the West. All other Malaysian species have their area within that of *P. neriifolia. P. polystachya* is known from the eastern and southern coast of the Malay Peninsula, the islands between the Malay Peninsula and Sumatra on the one side and Borneo on the other side, the western and southern coast of Borneo, the Talaud Islands, and the coasts of the Philippines, northwards to the Batanes Islands. This peculiar distribution recalls that of *P. Motleyi. P. Pilgeri* has its distribution east of Wallace's line as it has been modified by Merrill, and *P. Rumphii* nearly so. The former is spread from Celebes and the Moluccas to the Solomon Islands, the latter is found from the Philippines, southwards to the Lesser Sunda Islands, and eastwards to New Guinea, and has, moreover, been collected in one locality on Borneo's East-coast. Two mountain forms, *P. brevifolia* and *P. glauca,* are known from the Philippines and Mt. Kinabalu in North Borneo; all other species are known from a single island only.

Attention must be drawn to the richness in species of New Guinea, where as many as 14 species have been collected, 7 of which are endemic: *P. papuana, P. cincta, P. compacta, P. leptophylla* (all of the section *Dacrycarpus*), *P. Ledermannii, P. thevetiaefolia* and *P. Brassii* (of the section *Eupodocarpus*). Most of these species belong to the subalpine zone, the others to the montane zone.

Many species are known from a single locality: *P. Steupii* from Rante Mario in Celebes, *P. dacrydiifolia* from Oeloe Saloe in Celebes, *P. cincta* from Mt. Sarawaket in eastern New Guinea, *P. deflexa* from G. Tahan in the Malay Peninsula, *P. salomoniensis* from the Solomon

Islands, *P. Koordersii* from Noesa Kambangan south of Java, *P. Ledermannii* from the Lordberg in Eastern New Guinea.

VERTICAL DISTRIBUTION.

After the elevation, at which they grow, the Malaysian species of *Podocarpus* may be distinguished in the following groups:

1. Species growing near the sea shore or in low, often swampy regions at low elevations, such as *P. polystachya* and *P. Motleyi.*

2. Species growing at rather low elevations, such as *P. Koordersii, P. neriifolia* var. *Teysmannii* and var. *polyantha.*

3. Species growing both in the tropical and in the lower parts of the montane zone, between 1000 and 2400 m elevation, such as *P. Rumphii* and *P. Blumei.*

4. Species with their main distribution in the montane zone; to this group belong the most common species: *P. imbricata*, incl. the var. *curvula, P. papuana, P. dacrydiifola, P. amara, P. neriifolia, P. deflexa, P. Ledermannii, P. glauca, P. Pilgeri,* and *P. vitiensis,* perhaps also *P. thevetiaefolia* and *P. salomoniensis. P. neriifolia,* however, also descends to sea level, *P. amara* to 300 m elevation. On the other hand, *P. Pilgeri, P. imbricata* and its var. *curvula* may extend far into the subalpine zone.

5. Species mainly or exclusively growing in the subalpine zone, between 2400 and 4200 m elevation: *P. compacta, P. cincta, P. Steupii, P. imbricata* var. *kinabaluensis, P. brevifolia, P. Brassii,* and probably also *P. Cumingii, P. leptophylla,* and *P. neriifolia* var. *atjehensis.* Several species of this group reach the tree limit, e. g. *P. imbricata* var. *kinabaluensis* and *P. brevifolia* on Mt. Kinabalu in Borneo, *P. compacta* and *P. Brassii* in the mountains of New Guinea. Especially the species of the latter group take the shrub form at high altitudes.

About the vegetation types, in which the different *Podocarpus* species occur, few remarks may be made.

In general, the Malaysian *Podocarpi* grow scattered in forests of dicotyledonous trees. The only reference to continuous *Podocarpus* forests is made by Junghuhn (Java, 1, 1851, 509), who says, that *P. imbricata* grows gregariously on some Javan mountain summits and covers the slopes. Also Conifer forests, in which *Podocarpus* species take an important part, are rather rare. Gibbs (Journ. Linn. Soc., 42, 1914, 36, 41) describes shrub formations, composed by *Podocarpus brevifolia, P. imbricata* (var. *kinabaluensis*), *Phyllocladus hypophylla* and *Dacrydium Gibbsiae,* found by her near the tree limit, and on

exposed slopes of Mt. Kinabalu. At lower elevations these species become more and more intermingled with dicotyledonous trees. Conifer forests in which *Podocarpus* species take a more or less important part, are more often mentioned from New Guinea. Lane-Poole (For. Res. Papua, 1925, 41) mentions such forests from Mt. Obree; here *P. thevetiaefolia* and *Xanthomyrthus longicuspis* together occupy over 80 % of the surface, and at the summit *P. thevetiaefolia* alone more than 50 %. A forest between the Upper Mimai and the Main Divide was (idem, p. 40), for the greater part composed of *Araucaria Cunninghamii* (36.96 %) and *Phyllocladus hypophylla* (28.9 %), whereas *Podocarpus amara* (with 7.52 %), *P. imbricata* (with 4.21 %) and *P. neriifolia* (with 0.51 %) together with *Quercus* and *Eugenia* species are of less importance. In a forest on Mt. Obree (p. 37) the major part of the vegetation was occupied by Conifers, among which also *Libocedrus papuana*, but *Quercus lamponga* and *Q. spicata*, *Eugenia*, *Cryptocarya*, and *Sideroxylon novoguineensis* (recte *Planchonella obovata*) were more abundant than in the former case. Forests of the Ubua Mts., near Laruni, consisted for 62.5 % of *Araucaria Cunninghamii*, for 18.6 % of *Quercus* sp., and for 4.8 % of *Podocarpus imbricata*. Lam (Fragm. Pap., 1928) described forests of Mt. Doorman mainly consisting of Conifers. As appears from the Conifers collected by him in this mountain, especially *Podocarpi* of the section *Dacrycarpus* are abundant. They were growing between 2430 and 2750 m elevation. Above 2750 m *Casuarina* and Conifers were the only trees. Also in the Arfak Mts. *Podocarpaceae* play an important part, as appears from the trees listed by Gibbs (Contrib. Arfak Mts., 1917, 27—32), such as *Podocarpus papuana*, *P. Rumphii*, *Dacrydium novoguineensis*, *Libocedrus arfakensis*, *Phyllocladus hypophylla*, and several Dicotyledonous species.

Steup mentions (Trop. Natuur, 27, 1934, 143), that in Central Celebes *Podocarpus neriifolia*, *P. imbricata*, *Phyllocladus hypophylla*, *Dacrydium elatum*, *Castanea acuminatissima*, *Eugenia* spp., and *Casuarina sumatrana*, constantly accompany *Agathis* in the *Agathis*-forests, but among them only *Phyllocladus* is abundant.

Podocarpus species sometimes occur in woods, which for the rest consist of few species of Dicotyledons only. According to herbarium labels, *Podocarpus imbricata* often occurs in the lower parts of the East-Javan *Casuarina* woods. According to De Voogd (Trop. Natuur, 27, 1938, 63), the summit of Mt. Moetis in Timor bears a pure *Eucalyptus* forest, but between 1500 and 2000 m elevation *Eucalyptus*

is intermingled with *Podocarpus imbricata* and *P. neriifolia* (var. *timorensis*) and as an undergrowth *Pygium latifolium*. Lane-Poole (l. c., p. 23) mentions *P. neriifolia* from forests around Embi Lake, which consist nearly entirely of *Anisophora polyandra* (65.14 %) and *Afzelia bijuga* (29.85 %).

A peculiar vegetation, in which *Podocarpaceae* occur, is that of the padangs, open sandy grounds with a heath-like vegetation. Such padangs with *Podocarpus* are described from the Malay Peninsula (cfr. Van Steenis, in Tijdschr. Kon. Aardr. Genootsch., 55, 1938, 756), Natoena Islands (Van Steenis, in Bull. Jard. Bot. Buitenzorg, sér. 3, XII, 1932, 151), and Borneo (Winkler, in Bot. Jahrb., 50, Suppl. vol. 1914, 204, and Witkamp & Posthumus, in Verslag Ned. Ind. Vereen. Natuurbesch., 1932, 81).

Most numerous are the indications in literature of forests, at different elevations, in which *Podocarpus* species are scattered between numerous other kinds of trees.

USE.

Different authors, e. g. Van Eeden (Houts. Ned. Ind., 1886; ed. 3, 1906), Filet (Plantk. Woordenboek, 1876), Gamble (Man. Ind. Timb., 1902), Ridley (Bull. Kol. Mus. Haarlem, 27, 1903), Koorders & Valeton (Bijdr. Booms. Java, 10, 1904), De Clercq (Nw. Plantk. Woordenb., 1909), Heyne (Nutt. pl. Ned. Ind., ed. 2, I, 1927), and Burkill (Dict. Econ. Prod. Mal. Pen., 2, 1935), mention that the wood of different *Podocarpi,* such as *P. imbricata, P. amara, P. Rumphii, P. neriifolia, P. Koordersii,* and *P. polystachya,* is used for building purposes and for making furniture. According to herbarium labels, *P. dacrydiifolia* is used for the same purposes. Especially *P. amara* and *P. imbricata,* which may be obtained in great quantities, are very useful in this respect. The wood of the latter species may also be used for making eating utensils, masts, tea boxes, and for carving figures. In general *Podocarpus* wood is not over-hard and easy to work. Especially when originating from high elevations it seems to be durable. Species growing near the sea shore are also used for making proas according to herbarium labels, e. g. *P. polystachya* and *P. neriifolia.* Species of the section *Nageia* furnish little durable wood and seem to be rarely used. The wood of *P. vitiensis* (sect. *Polypodiopsis*) on the contrary, is according to Gibbs (Ann. Bot., 26, 1912, 533) "the most valuable of the Fijian timbers, being not over-hard and very durable".

Other uses are rare. Ridley (ex Burkill l. c.) mentions, "that a decoction of the leaves of *P. neglecta*" (= *P. polystachya*) "may

be used as an alternative in rheumatism and for painful joints".

The most useful species, *P. imbricata* and *P. amara*, are nowadays abundantly planted for reafforestation purposes. As ornamental trees *P. imbricata, P. neriifolia, P. polystachya* and *P. macrophylla* ssp. *maki* are sometimes planted; the latter species is exclusively known as such in Malaysia.

Remarks to the keys. As flowers, fruits and seeds of many species are very inadequately (if at all) known, and are often little different in allied species, it was necessary to base the key for all species mainly on sterile materials. Where possible, the characters of the seeds and fruits were taken into account. The key thus obtained must necessarily be inadequate to determine all species with certainty. After each determination by means of it, the descriptions of the species must always be carefully matched.

In the section *Dacrycarpus*, however, fruits and seeds are rather completely known, with the exception of those of one species, and therefore a special key for this section based on the differences in these parts has been added.

In order to give an insight in the natural relationships of the sections it was desirable to furnish also a key to the sections based on the most essential characters. After having made use of this key, one may compare the descriptions of the species to which the plant in question appears to belong, or, for *Dacrycarpus*, the special key for this section.

Key to the subgenera and sections, based on the most essential characters.

1a. Female flowers spike-like, with 2—8 ovules, or with 1—2 ovules on the extremity of a small twig. Seed usually large, its testa with woody inner layer. Receptacle absent . . . . . Subgen. I. **Stachycarpus**, spec. 1.

b. Female flowers single in the leaf axils, or terminal on short lateral twigs. Ovule one, rarely 2. Receptacle present . . . . Subgen. II. **Protopodocarpus**, spec. 2—25

2a. Carpids connate with the ovules and overtopping them. Flowers terminal on short lateral twigs. Leaves small, scale-like or subulate or linear, often dimorphic . . . . Sect. 1. **Dacrycarpus**, sp. 2—9

Cfr. also the special key for this section, p. 379.

b. Carpids not connate with the ovules. Ovules usually much overtopping the very small carpid 3

3a. Leaves opposite 4

b. Leaves scattered, linear to oblong . . Sect. 4. **Eupodocarpus**, sp. 13—25

4a. Leaves large, broad, ovate to broadly lanceolate, with many longitudinal nerves . . . . Sect. 2. **Nageia**, sp. 10—11

b. Leaves small, with a single rib . . . . Sect. 3. **Polypodiopsis**, sp. 12

Key to all the species, as far as possible adapted to sterile materials.

1a. Leaves scale-like or subulate, or in young plants linear and bifariously arranged. Flowers terminal on short lateral twigs. (*Dacrycarpus*) . . 2
b. Leaves broader, with flat lamina, linear to ovate-elliptical 11
2a. Leaves scale-like or somewhat subulate, usually dorsiventrally flattened, usually entirely adpressed, 1.5—4 mm long 3
b. Leaves subulate, nearly adpressed, spreading or divaricate, 1.25—6 mm long 4
3a. Leaves nearly 1.5 mm long. Involucral leaves below the receptacle straight, usually quadrangular on transverse section or laterally flattened, abruptly narrowed into a fine apiculus, horizontally spreading, 2.5—5 mm long. Male flowers 2 mm in diam. Whole area, at 700—3000 m el. . 2. **P. imbricata**
b. Leaves 1.5—4 mm long. Involucral leaves dorsiventrally flattened, abruptly narrowed into a fine apiculus, usually adpressed, 2.5—5 mm long. Male flowers 2.5—3.5 mm in diam. Sumatra, Java, on high mountains . . . . 2. **P. imbricata** var. β **curvula**
4a. Leaves subulate, dorsiventrally flattened, very thin, horizontally spreading, but abruptly incurved below the middle, 1.25—2 mm long. New Guinea, at 3000 m el. . . . . 9. **P. leptophylla**
b. Leaves otherwise, thicker, usually longer 5
5a. Leaves short- and thick-subulate, strongly spreading, with the lower surface S-shaped, vaulted above, strongly keeled beneath, triangular to quadrangular on transverse section, 1.5—2.5 mm long. Involucral leaves below the receptacle straight, slightly laterally flattened, abruptly narrowed into an apiculus, horizontally spreading, up to 4 mm long. New Guinea, at 1450—3000 m el. . . . . 3. **P. papuana**
b. Leaves otherwise. Involucral leaves not horizontally spreading . . . 6
6a. Leaves strongly spreading, subulate, very falcate, very rigid, nearly quadrangular on transverse section, 2.5—3 mm long. Involucral leaves usually spreading, curved upwards, rather gradually narrowed into a fine point, 3—4 mm long. Celebes, at 3000 m el. . . . . 4. **P. Steupii**
b. Leaves spreading or nearly adpressed, 2.5—6 mm long. Involucral leaves erect and nearly adpressed, or erect-spreading, usually longer than the receptacle 7
7a. Leaves in the uppermost part of the twigs usually quinquefariously arranged, spreading, laterally flattened, 4—8 mm long; other leaves slightly spreading, nearly quadrangular on transverse section, 3—6 mm long. Involucral leaves laterally flattened, erect or erect-spreading, thick, 5—8 mm long. Apex of the carpid free. Borneo, Mt. Kinabalu, high elevations up to the tree limit . . . . 2. **P. imbricata** var. γ **kinabaluensis**
b. Quinquefarious, laterally flattened leaves few or absent. Involucral leaves usually adpressed, longer than the receptacle and often involucrating the seed, dorsiventrally flattened on transverse section or quadrangular . . 8
8a. Leaves rhomboidal on transverse section or rarely dorsiventrally flattened. Plants often with pinnately leaved twigs. Involucral leaves nearly rhomboidal on transverse section, 7—13 mm long. Apex of the carpid free or not so . 9

b. Leaves slightly dorsiventrally flattened, 2.5—6 mm long. Plants rarely with pinnately leaved twigs. Involucral leaves usually slightly dorsiventrally flattened, sometimes more quadrangular, 5—10 mm long. Apex of the carpid connate with the seed 10

9a. Subulate leaves very fine, rhomboidal on transverse section, spreading, 4—6 mm long; bifarious linear leaves very narrow. Involucral leaves 7—11 mm long. Apex of the carpid not free. New Guinea, at 2300—3000 m el . . . . 6. **P. cincta**

b. Subulate leaves usually much coarser, slightly dorsiventrally flattened or rhomboidal on transverse section, nearly adpressed, 3.5—6 mm long; bifarious linear leaves broader. Involucral leaves 7—13 mm long. Apex of the carpid free. Sumatra, Philippines, Borneo?, high mountains up to 3300 m el . . . . 5. **P. Cumingii**

10a. Leaves spreading, somewhat curved, 2.5—5 mm long. Involucral leaves 4—10 mm long. Plants densely branched. New Guinea, at 2600—4200 m el . . . . 8. **P. compacta**

b. Leaves somewhat more adpressed, 4—6.5 mm long Involucral leaves up to 10 mm long. Plants widely branched. Celebes, at 1800—2000 m el. 7. **P. dacrydiifolia**

11a. Leaves opposite 12

b. Leaves scattered 14

12a. Leaves small, 1.5—3 cm long by 3—5 mm broad, with a single rib, pinnately arranged (Sect. *Polypodiopsis*). New Guinea, Bismarck Archip., at 900—2000 m el. . . . . 12. **P. vitiensis**

b. Leaves much larger, with many longitudinal nerves. (Sect. *Nageia*) . . 13

13a. Leaves elliptical to broadly lanceolate, rather shortly, sometimes longer-acuminate, or more gradually narrowed into the apex, 7—23 cm long by 2—7 cm broad. Male flowers 3—6 in axillary peduncles. Throughout the whole area, with the exception of Central- and East-Java and the Lesser Sunda Islands, at 0—2100 m el . . . . 10. **P. Blumei**

b. Leaves elliptical or oblong, narrowed into the often slightly rounded apex, 3—6 cm long by 13—28 mm broad. Male flowers solitary in the leaf axils. Malay Peninsula, Sumatra, Borneo, at 0—500 m el. . . . 11. **P. Motleyi**

14a. Leaves linear-lanceolate, usually somewhat caudate-acuminate, 5—12 cm long by 6—14 mm broad; midrib impressed above. Terminal buds globose, obtuse. Male flowers usually 3 fasciculate on short axillary peduncles. Female flowers spike-like, with 2—3 ovules, without fleshy receptacle. Seed testa with fleshy outer layer and woody inner layer. Malay Archipelago, with the exception of Borneo, at 300—1800 m el. (Subgenus *Stachycarpus*) . . . . 1. **P. amara**

b. Leaves linear to oblong; midrib on the upper surface prominent, flat, or sometimes slightly impressed towards the apex. Terminal buds acute or obtuse. Male flowers single or in bundles of 2—8 in the leaf axils, usually sessile, rarely shortly peduncled. Female flowers axillary, with fleshy receptacle, usually composed of 2, rarely 3 or 4 fleshy scales. Ovules 1, rarely 2. Seed testa rather thin, bony (Sect. *Eupodocarpus*) 15

15a. Leaves all or for the majority deflexed 16

b. Leaves erect, spreading or divaricate 17

16a. Leaves all entirely deflexed, 10—27 cm long by 7—12 mm broad, 12—25 times as long as broad; midrib on the lower surface broadly channelled. Male flower buds nearly globose. Malay Peninsula (G. Tahan), at 1800—2000 m el. . . . . 13. **P. deflexa**

b. Leaves for the majority deflexed, those of the youngest vegetation period often not so, 7—18 cm long by 5—8.5 mm broad, 10—20 times as long as broad; midrib not channelled beneath. Male flower buds ovate-acute. Sumatra (Atjeh), at 2250—3300 m el. . . . . 17. **P. neriifolia var.** δ **atjehensis**

17a. Terminal buds globose or ovate, obtuse. Margins of leaves parallel . . 18

b. Terminal buds ovate or conical, acute 21

18a. Leaves broad-lanceolate, often rather abruptly short-acuminate, 8.5—17 cm long by 16—26 mm broad, 5—9 times as long as broad. Sumatra, Riau, Bangka, Borneo, at 0—450 m el . . . . 17. **P. neriifolia var.** ε **Teysmannii**

b. Leaves narrow, linear-lanceolate, at least 10 times as long as broad . . 19

19a. Terminal buds large, ovate. Leaves usually thin-coriaceous, flexible, 10—18 cm long by 7—16 mm broad, 10—20 times as long as broad, rather gradually narrowed towards the apex; midrib narrowly prominent, or prominent as a narrow line. Male flower buds large, ovate, obtuse. Java . . . . 17. **P. neriifolia** var. ζ **linearis**

b. Terminal buds globose. Leaves thick-coriaceous, rigid; midrib on the upper surface prominent but not sharply delimited, or prominent as a narrow line, flat or slightly impressed towards the apex 20

20a. Male flowers in bundles of 2—8. Flower buds globose. Leaves 13—21 cm long by 9—18 mm broad, 12—24 times as long as broad, rather gradually narrowed towards the apex. Java (Noesa Kambangan), at 50 m el. 15. **P. Koordersii**

b. Male flowers solitary. Flower buds subglobose. Leaves 6—23 cm long by 8—23 mm broad, 8—17 times as long as broad, rather shortly or gradually narrowed towards the apex. Borneo, Philippines, Celebes, Moluccas, Lesser Sunda Islands, New Guinea, at 0—1650 m el. . . . . . 16. **P. Rumphii**

21a. Midrib on the upper surface little rounded-prominent, prominent as a narrow line, flat, or slightly impressed 22

b. Midrib on the upper surface strongly prominent, sharply delimited . . 25

22a. Leaves usually obtuse, 2.5—8 cm long by 5—9 mm broad, 4—11 times as long as broad; midrib flat or slightly impressed. New Guinea . . . . 21. **P. thevetiaefolia**

b. Leaves acute; midrib usually impressed towards the apex 23

23a. Leaves linear-lanceolate, with the margins parallel, shortly or rather gradually narrowed towards the apex, 6—23 cm long by 8—23 mm broad, 8—17 times as long as broad. Borneo, Philippines, Celebes, Lesser Sunda Islands, Moluccas, New Guinea, at 0—1650 m el . . . . 16. **P. Rumphii**

b. Leaves usually lanceolate, with the margins not parallel 24

24a. Leaves very gradually narrowed towards the apex, with the largest width below the middle, 5—13 cm long by 6—12 mm broad, 7—13 times as long. as broad. Malay Peninsula, at 650—1000 m el . . . . 17. **P. neriifolia** var. η **Ridleyi**

b. Leaves rather shortly narrowed towards the apex, 3.5—6.5 cm long by

8—11 mm broad, 4—6 times as long as broad. Timor, at 1500—2000 m el. . . . . 17. **P. neriifolia** var. ε **timorensis**

25a. Leaves usually narrowed at the apex, obtuse 26
b. Leaves abruptly or gradually rounded towards the apex, acute . . . 28

26a. Leaves more or less spreading, with the margins not or only slightly incurved, 1.5—8 cm long by 4—13 mm broad, 2.5—7 times as long as broad. Male flowers solitary. Peduncles of the fruits rather long and slender. Philippines, Celebes, Obi, New Guinea, Solomon Islands, at 700—3000 m el. 22. **P. Pilgeri**
b. Leaves usually erect-spreading or adpressed, usually with incurved margins 27

27a. Leaves lanceolate-spathulate, 3—7.5 cm long by 4—7 mm broad, 7—12 times as long as broad, very gradually narrowed towards the nearly sessile base. Male flowers in bundles of 3—5. Female peduncles rather long. Cultivated . . . . 20. **P. macrophylla** ssp. **maki**
b. Leaves oblong-lanceolate, 1—2.25 cm long by 3.5—6 mm broad, 3—5 times as long as broad, not very gradually narrowed into a short petiole. Male flowers single. Female peduncles very short. Mindoro, Borneo (Mt. Kinabalu), at 1300—1700 m el. . . . . 24. **P. glauca**

28a. Leaves often abruptly and shortly acuminate towards the apex . . . 29
b. Leaves abruptly or gradually narrowed towards the apex, sometimes slightly long-acuminate 30

29a. Leaves oblong or oblong-lanceolate, nearly caudate-acuminate, 3.5—5 times as long as broad, 6—12 cm long by 17—28 mm broad; midrib prominent on both surfaces. New Guinea, at 1000 m el . . . . 18. **P. Ledermannii**
b. Leaves lanceolate, less strongly acuminate, 4.5—8 times as long as broad, 6—16 cm long by 13—20 mm broad, often with a furrow on the lower surface instead of the midrib. Female flowers numerous, scattered all over the youngest vegetation periods. Ovules 1—2. Sumatra (Palembang), at 75—600 m el . . . . 17. **P. neriifolia** var. ι **polyantha**

30a. Scales of the terminal leaf buds and the male flower buds membranous. Leaves lanceolate, 6—10 cm long by 7—10 mm broad, 7—10 times as long as broad. Celebes, at 1300 m el . . . 17. **P. neriifolia** var. γ **membranacea**
b. Scales of the buds herbaceous or coriaceous 31

31a. Leaves more than 10 times as long as broad 32
b. Leaves less than 10 times as long as broad 34

32a. Leaves thick-coriaceous, very narrowly lanceolate, 12—18 cm long by 6.5—8 mm broad, 18—23 times as long as broad. Receptacle composed of 4 fleshy scales, of which 2 fertile. Solomon Islands, at 1000 m el . . . . 14. **P. salomoniensis**
b. Leaves thin- or rather thick-coriaceous, sometimes with the margins parallel, lanceolate or linear-lanceolate. Receptacle composed of 2 fleshy scales . 33

33a. Male flower buds small, globose or globose-ovate, obtuse. Leaves 3—24 cm long by 6—28 mm broad, 3—20 times as long as broad. Whole area, at 0—2850 m el . . . . 17. **P. neriifolia**
b. Male flower buds large, ovate, acute. Leaves 10—17 cm long by 9—14 mm broad, 8—15 times as long as broad. Java . . . . 17. **P. neriifolia** var. β **bracteata**

34a. Leaves 3—10 cm long by 4—12 mm broad, 5—10 times as long as broad,

with the margins usually parallel, abruptly narrowed towards the apex; midrib broadly channelled beneath. Male flowers in bundles of 3—5. Female peduncles very short and thick. Malay Peninsula, islands East of Sumatra, Borneo, Philippines, Talaud Islands (Karakelang), at very low el. . . . . **19. P. polystachya**

b. Leaves rather shortly or gradually narrowed towards the apex, with the margins not parallel 35

35a. Leaves thin-coriaceous 36

b. Leaves thick-coriaceous, rigid 37

36a. Leaves lanceolate, apex without fine point. Male flowers 1—3 together. Female peduncles slender. Whole area, at 0—2850 m el . **17. P. neriifolia**

b. Leaves lanceolate, or slightly spathulate, often with a fine point or an obtuse apiculus at the apex, 1.5—8 cm long by 4—13 mm broad, 2.5—7 times as long as broad. Male flowers solitary. Female peduncles slender. Philippines, Celebes, Obi, New Guinea, Solomon Islands, at 700—3000 m el . . . . **22. P. Pilgeri**

37a. Leaves erect-spreading, on 1—3 vegetation periods, oblong-lanceolate, 3—7.5 mm long by 8—14 mm broad, 4—6 times as long as broad; midrib broadly channelled beneath. Riau, Karimata Arch., Borneo, at low el. . . . . **19. P. polystachya** var. *β* **rigida**

b. Leaves usually adpressed to the twigs, usually on 2—5 vegetation periods. Bud scales often partly persistent 38

38a. Leaves usually lanceolate, acute, 1.5—5.5 cm long by 4—7 mm broad, 3—8 times as long as broad. Male flowers thick, 4—5.5 mm in diam.. Female peduncles very short, 2—4 mm long, strongly flattened. Luzon, Mindanao, Borneo (Mt. Kinabalu), above 3000 m el. . . . . . . **23. P. brevifolia**

b. Leaves elliptical-oblong to oblong-lanceolate, acute, but often with a small obtuse apiculus 39

39a. Leaves sometimes more spreading, 1.5—8 cm long by 4—13 mm broad, 2.5—7 times as long as broad. Male flowers slender, 2—3.5 mm in diam.. Female flowers on usually slender, 3—12 mm long peduncles. Philippines, Celebes, Obi, New Guinea, Solomon Islands, at 700—3000 m el. **22. P. Pilgeri**

b. Leaves nearly always adpressed, 1—1.8 cm long by 3—7 mm broad, 2—5 times as long as broad. Male flowers thick, 3—7 mm in diam.. Female peduncles short, thick, 3—9 mm long. New Guinea, at 3000—3700 m el. . . . . **25. P. Brassii**

Key to the species of the section Dacrycarpus, for fruit-bearing materials.

1a. Leaves very thinly subulate, divaricate, but abruptly incurved below the middle, very strongly dorsiventrally flattened, 1.25—2 mm long. New Guinea, at 3000 m el . . . . **9. P. leptophylla**

b. Leaves thicker, scale-like or subulate, 1.5—6 mm long, sometimes with linear, bifariously arranged leaves 2

2a. Sterile involucral leaves below the receptacle horizontally or strongly spreading 3

b. Sterile involucral leaves erect-spreading, or erect and adpressed . . 5
3a. Involucral leaves straight, usually horizontally spreading, abruptly narrowed into a fine point, usually somewhat laterally flattened 4
b. Involucral leaves usually somewhat incurved, usually spreading, more gradually narrowed into a fine point, triangular or quadrangular on transverse section. Celebes, at 3000 m el . . . . **4. P. Steupii**
4a. Typical leaves scale-like or somewhat subulate, usually adpressed, usually strongly dorsiventrally flattened. Whole area, at 700—3000 m el. . . . . **2. P. imbricata**
b. Typical leaves shortly-subulate, strongly spreading, vaulted above, keeled beneath, the lower surface with an S-shaped curvation. New Guinea, at 1450—3000 m el . . . . **3. P. papuana**
5a. Involucral leaves not or hardly longer than the receptacle, dorsiventrally flattened. Sumatra, Java, at 1400—3300 m el. . . . . **2. P. imbricata** var. β **curvula**
b. Involucral leaves usually much longer than the receptacle 6
6a. Involucral leaves very laterally flattened. Borneo (Mt. Kinabalu), above 3000 m el . . . . **2. P. imbricata** var. γ **kinabaluensis**
b. Involucral leaves dorsiventrally flattened or quadrangular on transverse section 7
7a. Typical leaves nearly quadrangular on transverse section; involucral leaves quadrangular on transverse section, 7—13 mm long, often involucrating the seed 8
b. Typical leaves somewhat dorsiventrally flattened; involucral leaves dorsiventrally flattened or quadrangular on transverse section, 5—10 mm long, usually only involucrating the basal part of the seed 9
8a. Apex of the carpid free, usually strongly prominent. Typical leaves usually more adpressed and coarser than in the following species. Leaves of the pinnate lateral twigs linear, rather broad. Sumatra, Philippines, Borneo ?, at high el., up to 3300 m . . . . **5. P. Cumingii**
b. Apex of the carpid connate with the seed, hardly prominent. Typical leaves very fine. Leaves of the pinnate lateral twigs very narrowly linear. New Guinea, at 2300—3000 m el. . . . . **6. P. cincta**
9a. Involucral leaves dorsiventrally flattened. Typical leaves slightly spreading, 4—6.5 mm long. Plants widely branched. Celebes, at 1800—2000 m el. . . . . **7. P. dacrydiifolia**
b. Involucral leaves quadrangular on transverse section or dorsiventrally flattened. Typical leaves spreading, somewhat incurved, 2.5—5 mm long. Plants densely branched. New Guinea, at 2600—4200 m el. . . **8. P. compacta**

I. Subgen. STACHYCARPUS Engler

§ *Taxoideae* Bennett, in Horsfield, Pl. jav. rar., 1 (1838) 40. — Sect. *Stachycarpus* Endlicher, Syn. Conif. (1847) 218; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 399; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 518; de Kirwan, Conif., 2 (1868) 224; Gordon, Pinetum, ed. 2 (1875) 351; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1889) 105;

Pilger, in Engl., Pflanzenreich, IV, 5 (1903) 63; in Engl. & Pr., Nat. Pflanzenfam., Nachtr. 3 (1908) 3; Foxworthy, in Philipp. Journ. Sc., 6 (1911) Bot., 158; Stiles, in Ann. Bot., 26 (1912) 448; Gibbs, in Ann. Bot., 26 (1912) 537. — Subgen. *Stachycarpus* Engler, in Engl. & Pr., Nat. Pflanzenfam., Nachtr. (1897) 21; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 242, 245; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 262, 266.

Male flowers in terminal spikes, single or several together in the axils of bracts or leaves, or rarely several together fasciculate at the

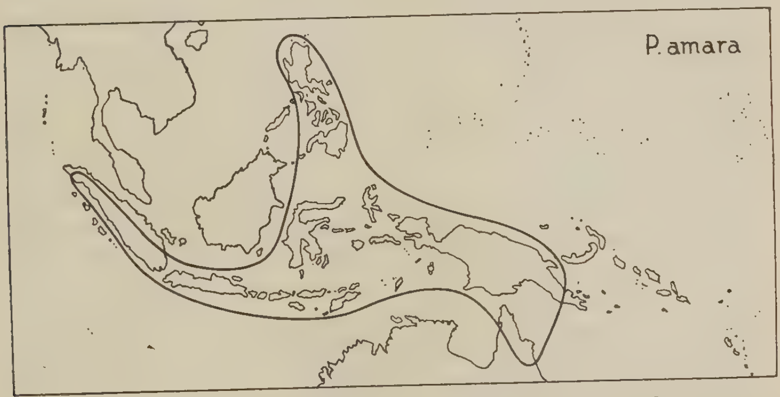

Fig. 1. Area of the only Malaysian species of the subgenus *Stachycarpus*.

apex of a naked peduncle*. Female flowers spike-shaped, composed of a woody twig with 2—8 remote, fertile carpids*, or the ovules 1—2 on the apex of a small leafy or scaly twig; carpids small, receptacle wanting; seed usually large or very large, the inner layer of its testa often thick and woody, the outer layer often fleshy. — Trees, often very tall; leaves scattered* or bifariously arranged, lanceolate or linear-lanceolate*, or small and linear; stomata on the lower surface only.

* Only the characters marked with an asterisk bear upon the species indigenous to the area dealt with.

1. **Podocarpus amara** Blume — *Podocarpus Sprengelii* Blume, in Flora, VII, 1 (1824) 292, nomen. — *Podocarpus amara* Blume, Enum. pl. Javae, 1 (1827) 88; Bennett, in Horsfield, Pl. jav. rar. (1838) 40; *Hasskarl, Cat. pl. Hort. Bot. Bog. (1844) 70; Endlicher, Syn. Conif. (1847) 217; Blume, Rumphia, 3 (1847) 213, t. 170; Junghuhn, Java, 1

(1851) 507; Walpers, Annal., 3 (1852) 448; Dietrich, Syn. pl., 5 (1852) 446; Miquel, Fl. Ind. Bat., II, 6 (1859) 1073; Kurz, in Nat. Tijdschr. Ned. Ind., 27 (1864) 216; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 395; Teysmann & Binnendijk, Cat. plant. Hort. Bot. Bog. (1866) 14; De Boer, Conif. Arch. Ind. (1866) 20, 28, 35, 36, 37; Carrière, Conif., II, ed. 2 (1867) 667; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 516; de Kirwan, Conif., 2 (1868) 228; Gordon, Pinetum, ed. 2 (1875) 327; Filet, Plantk. Woordenb. (1867) 138, 180, 182; Van Eeden, Houts. Ned. Ind. (1886) 135; Warburg, Monsunia, 1 (1900) 192; Koorders, in Nat. Tijdschr. Ned. Ind., 62 (1902) 216; *Pilger, in Engl., Pflanzenr., IV, 5 (1903) 68, ic. 13, A—D; Koorders & Valeton, Bijdr. Booms. Java, 10 (1904) 263; Van Eeden, Houts. Ned. Ind., ed. 3 (1906) 255; *Foxworthy, in Philipp. Journ. Sc., 2 (1907) Bot., 159; Pilger, in Engl. & Pr., Nat. Pflanzenfam., Nachtr. 3 (1908) 4; De Clercq, Plantk. Woordenb. (1909) 309; *Koorders-Schumacher, Syst. Verz., 1, Fam. 5 (1910) 1; *Foxworthy, in Philipp. Journ. Sc., 6 (1911) Bot., 159; Koorders, Exkursionsfl. Java, 1 (1911) 64, ic. 1; *Stiles, in Ann. Bot., 26 (1912) 451, textfig. 1, c, t. 47, ic. 17; Hallier, in Meded. Rijks Herb. Leiden, 14 (1912) 34; *Koorders, in Bot. Jahrb., 50, Supplem. Band (1914) 297; Boldingh, Cat. Herb. Pl. Hort. Bog. (1914) 4; Koorders & Valeton, Atl. Baumart. Java, 3 (1915) t. 590, 591; *Pilger, in Bot. Jahrb., 54, 1 (1916) 37; 54, 3 (1916) 208; Beekman, in Meded. Proefst. Boschw., 5 (1920) 169, t. 56; Lörzing, in Trop. Nat., 10 (1921) 99; Den Berger, in Meded. Proefst. Boschw., 7 (1922) 40, ic. 15; Koorders, Fl. Tjibodas, I, 2 (1922) 2; *Merrill, Enum. Phil. Fl. Pl., I, 1 (1923) 2; Seifritz, in Bull. Torr. Bot. Club, 50 (1923) 292; Lane-Poole, For. res. Papua (1925) 73, 37, 40, 64, 65; *Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 245, ic. 131, A—D; Heyne, Nutt. Pl. Ned. Ind., ed. 2 (1927) I, 108; *Dakkus, in Bull. Jard. Bot. Buitenz., sér. 3, suppl. vol. 1 (1930) 236; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 262, 263, 266, ic. 73, b—c; von Malm, in Fedde, Repert., 34 (1934) 266; Janssonius, Mikrographie, 13 (1936) 478; Steup, in Trop. Nat., 27 (1938) 143; *Francis, in Queensl. Agric. Journ. (1939) 5; Wasscher, in Backer, Bekn. Fl. Java, 2 (1940) Fam. 18, 2. — *Podocarpus eurhyncha* Miquel, Fl. Ind. Bat., II, 6 (1859) 1074; supplem. Sumatra (1860) 252, 589; De Boer, Conif. Arch. Ind. (1866) 24, 28, 36, 37, t. III, 2; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 518; Gordon, Pinetum, ed. 2 (1875) 336; Filet, Plantk. Woordenb. (1876) 270; Fern.-Vill., Noviss. App. (1880) 211; Warburg, Monsunia, 1 (1900) 193; — *Podocarpus dulcamara* Seemann, in Bonplandia, 9 (1861) 253;

10 (1862) 365. — *Nageia amara* et *N. eurhyncha* Kuntze, Rev. gen. pl., 2 (1891) 800. — *Podocarpus pedunculata* Bailey, in Queensl. Agric. Journ., V, 4 (1899) 390, 404, t. 149; Queensl. Fl., 5 (1902) 1498; Compreh. Catal. Queensl. Pl. (1913) 510; Baker, Hardwoods Austr. (1919) 429.

* *P. amarus.*

Twigs scattered or subverticillate, spreading, rather slender, terete, with thickened base, more angular between the leaves. Terminal buds, small, globose; bud scales orbicular, ovate or obovate, obtuse, up to 2 mm long. Leaves scattered, spreading, somewhat coriaceous, usually straight, linear-lanceolate, with the margins parallel over a great part of the length, cuneately narrowed into the short petiole, usually slightly caudate-acuminate towards the rather obtuse apex, 5—15 (usually 8—11) cm long by 6—14 (usually 8—11) mm broad, 7—11 × as long as broad; midrib usually impressed in a narrow furrow above, broader and slightly prominent beneath; lamina with slightly recurved margins, shining above, dull beneath. Leaves of young plants more oblong-lanceolate, with abruptly and strongly caudate-acuminate apex, 4—11 cm long by 9—20 mm broad, 3.4—7 × as long as broad. Male flowers 1—4 (usually 3) on the top of very short, 1—5 mm long, usually somewhat flattened peduncles in the leaf axils, sometimes in more compound inflorescences; flowers cylindrical, up to 3.5 cm long and 3.5 mm in diameter, in the axils of triangular, adpressed, decurrent bracts, with few sterile scales at the base, which hardly differ from the stamens; connective with short, triangular, acute apiculus; pollen grains with 2 air bladders. Female flowers single in the leaf axils, composed of a spicate twig 3—5 cm long, with some crowded scars at the base and some remote scars in the lower half, the upper portion with 2—3 divaricate, ovate-triangular, obtuse, usually spreading, nearly 2 mm long carpids, which are decurrent on the thickened axis and 0.5—1 cm remote from each other; ovule nearly ovate, longer than the carpid, acuminate towards the furrowed apex; seeds 1—2, globose, with small, obtuse apiculus, up to 2.5 cm in diameter; testa composed of 2 layers, the outer one fleshy, 2—3.5 mm thick, the inner one hard and woody 1.5—2 mm thick. (Description from all the specimens examined.) Cfr. *Fig. 1.*

According to herbarium labels, *P. amara* is a tree up to 60 m tall and with a straight, columnal bole to 2 m in diameter, without buttresses, with greyish bark and horizontally spreading branches. The crown is usually irregular and usually occupies one-fourth to one-half

of the total height. The fruit is dark blue (Wind 6506), bluish black (Koorders 1216), red (Toxopeus s.n.) or black (Koorders 1219). The taste of the young fruit is bitter (b.b. 7192, b.b. 2924).

P. amara occurs in old, primary forests from 800 to 2000 m elevation, only rarely descending to 300 m, and once collected at 3600 m elevation (both New Guinea). It is, apart from the characters of the section, easily recognised in the sterile state by the small, globose terminal buds, the linear-lanceolate leaves somewhat caudate-acuminate towards the apex, and the midrib impressed on the upper surface.

On the very abruptly caudate-acuminate leaves of young plants Miquel based his *P. eurhyncha*. The leaves of adult trees are, according to Lane-Poole, up to 21 cm long. According to Seemann, the leaves have a sweet-bitter taste, whence the name *P. dulcamara* of this author. The seed is, according to Koorders and Pilger, up to 3 cm in diameter. According to Koorders' Exkursionsflora, the seed is black-purple, with bluish bloom; according to Francis it is bright red.

The male flowers are usually arranged in peduncled fascicles of three in the leaf axils, but sometimes they form more compound inflorescences; in the extreme case these inflorescences are composed of leafless twigs up to 3 cm long, bearing 3—5 fascicles of flowers as described above; in other cases we meet with inflorescences with 4—10 sessile, somewhat remote flowers on a common axis.

SUMATRA. Atjeh: subdiv. Gajo Loeëus, G. Agosan, 1800 m el., *Boschproefstation* b.b. 22449, v.n.: beboeloeh (B, s); Gajoe & Alas distr., Batok Toba (Koeta Bea), *Pringgo Atmodjo* 526 (B, L, f); Oostkust (E. coast): subdiv. Karo-landen, *Houtvester* Sum. Oostkust 17 (B, L, m); Sigoeroenggoeroeng, on Laoet Kawar, 1500 m el., *Boschpr.* b.b. 5444 (B, L, s); Bandar Baroe, 1250 m el., *Boschpr.* b.b. 8351, v.n.: sitoboe (B, L, m); Oedjoeng Gorep, 1525 m el., *Boschpr.* b.b. 7192, v.n.: sangka sempilit (B, f); East Siboeatan, 1350 m el., *Galoengi-Schnepper* 10, v.n.: sitoboe (B, m); East of the Siboeatan, near Pantjarbaroe, 1400 m el., *Lörzing* 7119 (B, L, m); *Boschpr.* b.b. 2778, v.n.: sitoboe (B, L, f); subdiv. Simeloengoen, near Pematang Siantar, 700 m el., *Boschpr.* b.b. 20391, v.n.: medang merah (B, s); Marihat-hoeta, Batoeloteng Reserve, 800 m el., *Boschpr.* b.b. 2924, v.n.: sitoboe (B, L, f); Westkust (W. coast): Batangbaroes, *Teysmann* 517 H. B., v.n.: sapie (B, U, s), originals of *Podocarpus eurhyncha Miquel*; G. Singgalang, *Beccari* P. S. 295 (L, s); subdiv. Kerintji Painan, Padang Melintang, 1100 m el., *Boschpr.* 18734 (B, s); Palembang: subdiv. Pasemahlanden, Pg. Oebar, marga Lb. Boenta-boenta, 1000 m el., *Boschpr.* T. B. 214, v.n.: kajoe boeloeh (B, L, s); Djangkar, 900 m el., *Boschpr.* b.b. 8130, v.n.: kajoe tadji (B, m).

BANGKA (very doubtful). Foot of G. Maras, near Pangkal-Lajang (ex *Kurz*, l. c.); cultivated in *Hort. Bot. Bogor.*, V. F. 91—91a, from Bangka (ex *Dakkus*, l. c.).

JAVA. Without exact locality, *Blume* s. n., v.n.: kiputri (L, m), perhaps ori-

ginals of the species; *Kuhl & Van Hasselt* s. n., v.n.: kimerak (L, m); West-Java: G. Gedé, *native coll.* s. n. (B, f); *"Houtsoorten van den Gedeh* 107", v.n.: ki-bima (L, m); *"Houtsoorten van den Gedeh* 637", v.n.: ki-putri lalakina (L, s); G. Gedé, Pasir Keroed, 1000 m el., *Boschpr.* Ja. 1908, v.n.: kimerak (B, L, s); *Boschpr.* Ja. 1909 (B, L, s); Tjibodas, coll.? (B, m); Tjibodas, 1425 m el., *Hallier* 183, v.n.: kibimah (B, s); *Koorders* for. no. 3074a, herb. no. 1245 (B, m), 1246 (B, L, s), 12607 (B, L, m), 41806 (B, s), v.n.: kajoe lilin or kililin; for. no. 3408a, herb. no. 42038, v.n.: kibima (B, s); 1500 m el., *Danser* 6100 (G, s); Tjibeureum, 1600 m el., *Koorders* 39352 (B, m), 39392, v.n.: kibima (B, L, f); Gegerbintang, *Koorders* for. no. 3235a, herb. no. 14326, v.n.: kibima (B, s); for. no. 3305a, herb. no. 15544, v.n.: kibima (B, f); 1500 m el., *Den Berger* 550 (B, L, s); Tjidjamboe, Soemedang (probably G. Boekittoenggoel), *Wind* 6506 (B, L, f); Takokak, *Koorders* for. no. 2124a, herb. no. 1238, v.n.: kimerak (B, s), 1239, v.n.: kibima (B, L, s), 11908 (B, L, s); 25577, v.n.: kimerak (B, L, s), 39623 (B, L, s); 1247 (B, s); G. Geulis (G. Kendeng, S.E. of Tjidadap & Tjibeber), 1000 m el., *Bakhuizen van den Brink* 5981 (B, s); *Bakhuizen van den Brink fil.* 3012 (U, s); Tjigenteng, *Koorders* for. no. 2197a, herb. no. 1241 (B, s), 1242 (B, m), 15748 (B, m), v.n.: kimerak; for. no. 2215a, herb. no. 15751, v.n.: kipait (B, L, m); for. no. 2216a, herb. no. 15752, v.n.: kipait (B, L, m); *Koorders* 1248 (B, L, m); Pengalengan, 1400 m el., *Opziener* Pengalengan X, v.n.: kimerak (W, f, m); Tjilaki near Pengalengan, *Warburg* 11117 (ex *Warburg* l. c.); G. Malabar, *Reinwardt* s. n. (L, s); *Kuhl & Van Hasselt* s. n. (L, s); Pangentjongan, *Koorders* for. no. 2416a, herb. no. 10944, v.n.: kimerak (B, f); for. no. 2416aa, herb. no. 14026, v.n.: kimerak (B, s), 14195 (B, L, s); 1400 m el., *Koorders* 13143, v.n.: kimerak (B, s); 1500 m el., *Koorders* 14185 (B, L, f, m); Pasir Ipis, *Koorders* for. no. 2442a, herb. no. 13855, v.n.: kimerak (B, s); 1500 m el., *Koorders* 14201 (B, m); Pangentjongan, G. Gloenggoeng, 1400 m el., *Koorders* 1257, v.n.: kimerak (B, s); near Koeboeran Tjimalaka, *Koorders* for. no. 2454aa, herb. no. 26576 (B, L, s); Pasir Kaboejoetan, *Koorders* for. no. 580*, herb. no. 26785 (B, L, f, m); Noesa Gedé in the Pendjaloe Lake, 720 m el., *Koorders* for. no. 99*, herb. no. 44322, v.n.: kibima (B, s); Central Java: G. Slamet, forest Bentjana, 1300—1400 m el., *Koorders* 1226, v.n.: kajoe toean (B, s); 1227 (B, s); 1228, v.n.: kajoe toean (B, s); N.W. G. Prahoe, forest Soerdja, 1400 m el., *Koorders* 11247, v.n.: kibima (B, L, s); G. Oengaran, Telemojo, *Koorders* for. no. 2268i, herb. no. 1220 (B, s); for. no. 2291i, herb. no. 1221 (B, s); for. no. 2432i, herb. no. 1224, v.n.: winong (B, s), 1225 (B, L, s); East-Java: G. Wilis, 2000 m el., *Warburg* 3531 (ex *Warburg*, l. c.); Ngebel, 1450 m el., *Koorders* for. no. 2099f, herb. no. 1216 (B, L, W, m), 1217 (B, s), 23340 (B, L, m), 38783, v.n.: tjemoro tikoeng (B, L, m); for. no. 2118f, herb. no. 1218 (B, L, f), 1219 (B, L, f), 38650, v.n.: tjemoro (B, L, f, m); for. no. 365*, herb. no. 29187, v.n.: tedji (B, f); G. Ardjoeno, 1800 m el., *Koorders* for. no. 2094*, herb. no. 38189 (B, s); G. Tengger, Tosari, forest Sekorkoening, 1650 m el., *Koorders* for. no. 1928*, herb. no. 37924, v.n.: tadji (B, L, s); G. Argobajoe, 1700 m el., *Bremekamp* s. n., v.n.: tadji (B, s); G. Ijang, Bermi-Taman Hidoep, 1500—2000 m el., Van Steenis 10844 (B, m); G. Kendeng, near Kajoemas, 1100 m el., *Backer* 30723 (B, L, f); Pantjoer Idjen, *Koorders* for. no. 4016t, herb. no. 1231 (B, L, m), 14377, v.n.: radin (B, s); for. no. 4117t, herb. no. 1232, v.n.: rodin (B, f), 1233, v.n.: rhadin (B, L, f), 14367, v.n.: radin (B, f), 28508, v.n.: radin (B, L, f); for. no. 4178t, herb. no. 14378, v.n.: radin (B, L, m), 21093

(B, L, m); for. no. 4185t, herb. no. 14379, v.n.: radin (B, f), 28506 (B, f), 32478 (B, f); for. no. 4202t, herb. no. 14380, v.n.: radin (B, L, f); for. no. 9426t, herb. no. 1234, v.n.: rodin (B, L, s), 1235, v.n.: radin (B, f); for. no. 889*, herb. no. 28503 (B, m); for. no. 2212*, herb. no. 21092 (B, m); for. no. 3446*, herb. no. 32439, v.n.: raden (B, s); *Koorders* 14381, v.n.: radin (B, f); 14382, v.n.: radin (B, m).

LESSER SUNDA ISLANDS. Bali: subdiv. Kloengkloeng, Pengadjaran, 1100 m el., *Boschpr.* b.b. 11784, v.n.: tjempadak (B, f); Tjatoer, 1200 m el., *Boschpr.* b.b. 16997, v.n.: tjempandak (B, s). Lombok: N. side of G. Rindjani, below Tengengeah, 950—1500 m el., *Elbert* 982 (L, s); Tengengeah, 1450—1600 m el., *Elbert* 996 (L, s). Soembawa: Batoelanteh, 1400 m el., *De Voogd* 1649 (B, s). Soemba: Djagasnange, 975 m el., *Boschpr.* b.b. 5401, v.n.: bokhaoe (B, s). Timor: subdiv. Koepang, Leok, 800 m el., *Boschpr.* b.b. 17582, v.n.: haoe loeganel (B, f).

PHILIPPINE ISLANDS. Luzon: Benguet prov., *For. Bur.* 10895 coll. *Curran* (B, f); Lepanto subprov., *For. Bur.* 10951 coll. *Curran* (ex *Foxworthy*, in Phil. J. Sc., 6, 159). Mindoro: Mt. Halcon, 1800 m el., *Merrill* 5703 (ex *Foxworthy*, in Phil. J. Sc., 2, 258). Mindanao: Davao distr., Todaya, Mt. Apo, *Elmer* 11539 (B, L, m); *Elmer* 11682 (B, L, U, f).

CELEBES. Rante Mario, above 1500 m el. (ex *Steup* l. c.); subdiv. Enrekang, Sawito, 1600 m el., *Boschpr.* b.b. 20785, v.n.: doke doke, doke laki (B, s); G. Bantaèng, Loka, *Teysmann* 14069 (B, L, s).

MOLUCCAS. Batjan: G. Sibéla, S. slope, 1000 m el., *Boschpr.* b.b. 23242 (B, s); Boeroe: Fat' Koton, 1450 m el., *Toxopeus* s. n. (B, L, f); Wa' Lata, 1000 m el., *Boschpr.* b.b. 21497, v.n.: biali (B, s).

NEW GUINEA. N.W. Part: Pikpik, 500 m el., *Boschpr.* b.b. 22247, v.n.: towar (B, s); Mt. Genofa, 300 m el., *Boschpr.* b.b. 22582, v.n.: efroewetana (B, s); N.E. Part: Etappenberg, 850 m el., *Ledermann* 9421 (BD, m); Felsspitze, 1400—1500 m el., *Ledermann* 13000 (BD, m); Morobe distr., Sattelberg, 1100 m el., *Clemens* 3113 (BD, s); Yunzaing, 1500 m el., *Clemens* 3854-bis (BD, m); Ogeramnang, 1900—2000 m el., *Clemens* 5325 (BD, f); Ogeramnang, *Lane-Poole* 552 (ex *Lane-Poole* l. c.); S.E. Part: Boridi, 3600 m el., *Carr* 13486 (BD, L, m); 1700 m, *Carr* 14765 (L, f); Owen Stanley Range, Mt. Obree—Laruni spur, above 2000 m el., *Lane-Poole* 377 (ex *Lane-Poole* l. c.).

Cultivated: in the Buitenzorg Botanic Garden, V. F. 27, from Java (B, s); in Botanic Garden Sibolangit no. 24 (B, s).

II. Subgen. **PROTOPODOCARPUS** Engler

in Engl. & Pr., Nat. Pflanzenfam., Nachtr. (1897) 21; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 242, 245; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 267.

Female flowers single, on axillary peduncles or terminal on short lateral twigs; receptacle usually present; ovules single, rarely two.

1. Sect. **Dacrycarpus** Endlicher

§ *Dacrydioideae* Bennett, in Horsfield, Pl. jav. rar., 1 (1838) 41. — Sect. *Dacrycarpus* Endlicher, Syn. Conif. (1847) 221; Miquel, Fl. Ind.

Bat., II, 6 (1859) 1074; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 403; De Boer, Conif. Arch. Ind. (1866) 25; Carrière, Traité Conif., ed. 2, II (1867) 676; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 520; de Kirwan, Conif., 2 (1868) 224; Gordon, Pinetum, ed. 2 (1875) 356; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1889) 105; Beissner, Nadelholzkunde (1891) 17; Pilger, in Engl., Pflanzenr., IV, 5 (1903) 55; in Engl. & Pr., Nat. Pflanzenfam., Nachtr. 3 (1908) 3; Foxworthy, in Philipp. Journ. Sc., 6 (1911) Bot., 156; Stiles, in Ann. Bot., 26 (1912) 448; Gibbs, in Ann. Bot., 26 (1912) 525; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 242, 245; Hickel, in Lecomte,

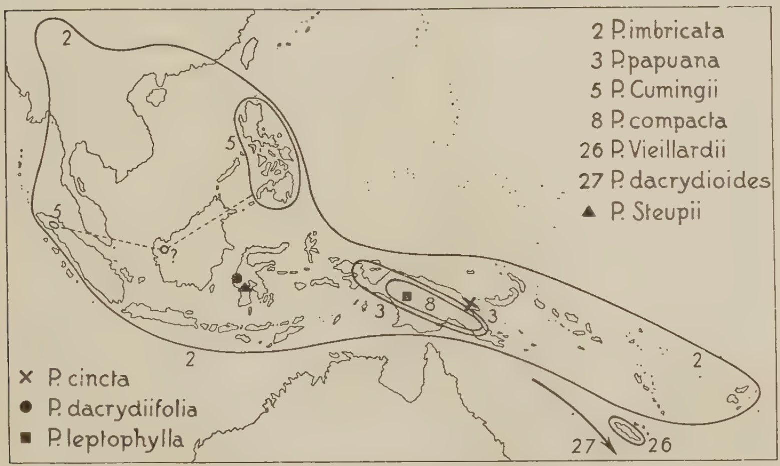

Fig. 2. Areas of the species of the section *Dacrycarpus*.

Fl. Indo-Chine, V, 10 (1931) 1066; Van Steenis, in Bull. Jard. Bot. Buitenzorg, sér. 3, XIII, 2 (1934) 194; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 267, 269; 19, 2 (1940) 23, 69, ic. 2.

Male flowers terminal on short lateral twigs, cylindrical; stamens only slightly different from the leaves; apiculus large. Female flowers terminal on short lateral twigs, of which the leaves surrounding the flowers are different from the typical ones; receptacle small, warty, composed of usually 2, sometimes more numerous fleshy leaf-bases, the sterile scales with short free lamina, the fertile ones with long free carpid, which overtops it at the apex; seed (incl. carpid and ephimatium) small, subglobose, with a coriaceous testa, which is distinguishable

from the carpid only at the apex. — Trees or shrubs, with very small, scale-like or subulate leaves, and especially in the young state moreover with short, sterile twigs with bifarious, linear leaves; stomata on both surfaces of the leaves.

2. Podocarpus imbricata Blume. — *Podocarpus cupressina* R. Brown, ex Mirbach, Geogr. Conif., in Mém. Mus. Hist. Nat., 13 (1825) 47, 75, nomen; Bennett, in Horsfield, Pl. Jav. rar., 1 (1838) 35, t. X; *Hasskarl, Cat. Plant. Hort. Bot. Bog. (1844) 70; Lindley, Veg. kingd. (1846) 231; Endlicher, Syn. Conif. (1847) 222; Blume, Rumphia, 3 (1847) 218, t. 172, ic. 2, 172-B, ic. 2; Junghuhn, Java, 1 (1851) 507, 546, 663; Miquel, Pl. Junghuhn, 1 (1851) 3; Walpers, Ann. Bot. Syst., 3 (1852) 449; Dietrich, Syn. Plant., 5 (1852) 447; Miquel, Fl. Ind. Bat., II, 6 (1859) 1074; Suppl. Sum. (1860) 252, 589; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 403; Seemann, Fl. vitiensis (1865—73) 267; Teysmann en Binnendijk, Cat. Plant. Hort. Bot. Bog. (1866) 14; de Boer, Conif. Arch. Ind. (1866) 25, 28, 35, 36, 37, 41, 42, 43, 51; de Sturler, Cat. descr. esp. bois (1867) 9; Carrière, Traité gén. Conif., ed. 2, II (1867) 677; de Kirwan, Conif., 2 (1868) 224; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 521; Gordon, Pinetum, ed. 2 (1875) 356; Filet, Plantk. Woordenb. (1876) 117, 180, 182; Beccari, Malesia, 1 (1878) 179; Fern.-Villar, Noviss. App. (1880) 211; Vidal, Sin. Atlas (1883) 43, t. 97, ic. B; Phan. Cuming. Philipp. (1885) 160; Van Eeden, Houts. Ned. Ind. (1886) 135; ed. 3 (1906) 255; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1887) 106; Hooker f., Fl. Br. Ind., 5, 3 (1888) 650; Wigman, in Teysmannia, 1 (1890) 196; Koorders, Plantk. Woordenb. (1894) 130; Stapf, in Transact. Linn. Soc., ser. 2, IV (1894) 249, 84, 86, 103, 107, 125, 127; Wigman, in Teysmannia, 8 (1898) 273, 279; Anonymus, in Kew Bull. (1899) 110; Warburg, Monsunia, 1 (1900) 191; Gamble, Man. Ind. Timb. (1902) 702; Koorders, in Nat. Tijdschr. N. I., 62 (1902) 216; Ridley, Bull. Kol. Mus. Haarlem, 27 (1903) 105 = Agric. Bull. Str. and Fed. Mal. States, 1, 289; *Wigman, in Teysmannia, 15 (1904) 5, 463; Koorders & Valeton, Bijdr. Booms. Java, 10 (1904) 262; Brandis, Ind. Trees (1906) 696; De Clercq, Plantk. Woordenb. (1909) 309; *Ridley, in Journ. Str. Br. Roy. As. Soc., 60 (1911) 58; Hallier, in Elbert, Sunda-Exped., 2 (1912) 293, ic. 159; *Stiles, in Ann. Bot., 26 (1912) 458; Elbert, in Meded. Rijksherb. Leiden, 12 (1912) 5; Hallier, in Meded. Rijksherb. Leiden, 12 (1912) 10; Boldingh, Cat. Herb. Plant. Hort. Bot. Bog. (1914) 4; Koorders, in Bot. Jahrb., 50, Suppl. Band (1914) 280; *Leefmans, in Trop. Nat., 3 (1914) 87; *Lörzing, in Trop. Nat., 3 (1914) 123; *Ridley, in Journ. Fed. Mal. St. Mus., VI, 3 (1915)

198; VIII, 4 (1917) 87; von Wiesner, Rohstoffe Pflanzenr., ed. 3, II (1918) 362; Beekman, in Meded. Proefst. Boschw., 5 (1920) 171, t. 56; Beccari, For. Borneo, ed. 2 (1921) 148; Lane-Poole, For. res. Papua (1925) 73, 35, 37, 38, 39, 40, 50, 60, 65; Ridley, ex Van Steenis, in Bull. Jard. Bot. Buitenz., sér. 3, XIII, 3 (1935) 338; Janssonius, Mikrographie, 13 (1936) 485. — *Podocarpus imbricata* Blume, Enum. pl. Javae, 1 (1827) 89; *Pilger, in Engl., Pflanzenr., IV, 5 (1903) 56; *Koorders-Schumacher, Syst. Verz., I, Fam. 5 (1910) 3; Koorders, Exkursionsfl. Java, 1 (1911) 64, ic. 2; *Foxworthy, in Philipp. Journ. Sci., 6 (1911) 157; Hallier, in Meded. Rijksherb. Leiden, 14 (1912) 34; Gibbs, in Ann. Bot., 26 (1912) 525, t. 49, ic. 1—9; Koorders, in Nova Guinea, VIII, 2 (1914) 616; *Koorders, in Bot. Jahrb., 50, Suppl. Band (1914) 297; Gibbs, in Journ. Linn. Soc., Bot., 42 (1914) 32, 35, 36, 41; Stapf, in Journ. Linn. Soc., 42 (1914) 193; Koorders & Valeton, Atlas Baumarten Java, 3 (1915) ic. 585, 586; *Pilger, in Bot. Jahrb., 54, 1 (1916) 36; *54, 3 (1916) 208; *Gibbs, Contr. Arfak Mts. (1917) 82; Merrill, Bibl. enum. Born. pl. (1921) 31; Lörzing, in Trop. Nat., 10 (1921) 98, fig. 1, 2; Koorders, Fl. Tjibodas, I, 2 (1922) 3; Seifritz, in Bull. Torrey Bot. Club, 50 (1923) 292, fig. 5; Lam, in Trop. Nat., 13 (1924) 20; *Ridley, Fl. Mal. Pen., 5 (1925) 283; *Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 245, ic. 124, E; Dammerman, in Trop. Nat., 15 (1926) 81; Delsman, in Trop. Nat., 15 (1926) 194, ic. 1; Heyne, Nutt. Pl. Ned. Ind., ed. 2, I (1927) 109; Schmucker, in Beih. Bot. Centralbl., 43, 2 (1927) 52, 63, 65; Lam, Fragmenta Pap., 5 (1928) 177 = Nat. Tijdschr. Ned. Ind., 88 (1928) 314; Van Steenis, in Trop. Nat., 17 (1928) 206; Jochems, in Trop. Nat., 18 (1929) 29; Docters van Leeuwen, in Bull. Jard. Bot. Buitenz., sér. 3, XI (1930) 29; Van Steenis, in Trop. Nat., 19 (1930) 76, 89; *Dakkus, in Bull. Jard. Bot. Buitenz., sér. 3, suppl. vol. I (1930) 236; Hickel, in Lecomte, Fl. Indo-Chine, V, 10 (1930) 1068; Guillaumin, in Journ. Arn. Arb., 13 (1932) 117; Van Steenis, in Trop. Nat., 21 (1932) 106; in Bull. Jard. Bot. Buitenz., sér. 3, XIII, 1 (1933) 18; *XIII, 2 (1934) 194; XIII, 3 (1934) 313, 338; Polak, in Verh. Kon. Akad. Wet. Amsterdam, XXX, 3 (1933) 66, 74, t. I, ic. 23, t. IV, ic. 134; Docters van Leeuwen, Verh. Kon. Akad. Wet. Amsterdam, 31 (1933) 16, 18, 19, 47, 49, 53, 66, 95; Steup, in Trop. Nat., 23 (1934) 62; *Merrill, in Contr. Arn. Arb., 8 (1934) 14; *in Proc. Fifth Pac. Sci. Congr. Can., 4 (1934) 3269; von Malm, in Fedde Rep., 34 (1934) 266; Van Steenis, in Tijdschr. Kon. Ned. Aardr. Gen., 52 (1935) 45, 52, 390; *Burkill, Dict. Econ. Prod. Mal. Pen., 2 (1935) 1779; *Pilger, in Bot. Jahrb., 68 (1936) 244; Van Steenis, in Bull. Jard. Bot.

Buitenz., sér. 3, XIV, 1 (1936) 59, 65; Venema, in Blumea, suppl. 1 (1937) 89; De Voogd, in Trop. Nat., 27 (1938) 63; Steup, in Trop. Nat., 27 (1938) 143; Van Steenis, in Tijdschr. Kon. Ned. Aardr. Gen., 55 (1938) 762, 790; Hoogerwerf, in Elfde Versl. Ned. Ind. Ver. Nat. besch. (1939) 263; Grevenstuk, in Trop. Nat., 28 (1939) 65; Wasscher, in Backer, Bekn. Fl. Java, 2 (1940), Fam. 18, 2; Florin, in Kungl. Svensk. Vet. Akad. Handl., 19, 2 (1940) 23, 69. — *Nageia cupressina* Kuntze, Rev. Gen. Plant., 2 (1891) 800. — **Podocarpus javanica* Merrill, in Philipp. Journ. Sc., 19 (1921) 338; *Enum. Philipp. Fl. Pl., I, 1 (1923) 3; Van Steenis, in Trop. Nat., 20 (1931) 169; *H. H. Hu, in Proc. Fifth Pac. Sc. Congr., 4 (1934) 3274, 3283, 3286; *Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 267, 268, 285, t. 29, ic. 10.
**imbricat*us, *javanic*us.

Seedlings and young, sterile main twigs covered with densely imbricate, adpressed, thin, dorsiventrally flattened leaves, which are narrowly triangular-subulate, 3—4 mm long and 0.75 (rarely up to 1.25) mm broad, sessile with broad base and decurrent on the twig, with prominent midrib on the lower surface, acuminate into a thin mucro towards the apex; sometimes the twigs partly with thicker, adpressed leaves, which are strongly keeled on the back, and sometimes slightly spirally twisted around the twig; rarely the leaves entirely laterally flattened and somewhat spreading. Sterile lateral twigs bifariously alternating on the main twigs, at distances of 0.5—3 cm from each other; leaves in a basal portion 3—10 mm long of the lateral twigs small, adpressed, imbricate, subulate, up to 2 mm long, for the rest pinnately arranged, thin-coriaceous, laterally flattened, linear, slightly falcate towards the base and the apex, attached to the twig with broad base, attenuate into a thin apical mucro, the longest middle ones 5—7 mm long by 0.75—2 mm broad, the pinnate leafy twigs nearly lanceolate-ovate or sometimes subelliptical in outline, 2—10 cm long by 7—30 (usually 10—22) mm broad; midrib slightly prominent; lamina shining and with a narrow line bearing 1—3 longitudinal rows of stomata along each side of the midrib on both surfaces. Youngest terminal shoots slender, sometimes very long (up to 20 cm) overtopping the youngest lateral twigs, bearing narrowly triangular-subulate leaves, penicillate terminal buds, and bifariously alternating lateral buds. Twigs in more adult trees very strongly branched and crowded; old twigs covered with the remnants of the triangular-subulate leaves decurrent with dilated base; lateral twigs often with thickened base, usually separated from the main twig by a groove, straight or slightly curved, slender, cord-shaped, 0.75—1.25 mm

in diam. incl. the leaves; the leaves densely imbricate, entirely adpressed, thick-coriaceous, dorsiventrally flattened, scale-like or slightly subulate, somewhat narrowed towards the base, rather shortly narrowed into a thin mucro towards the apex, about 1.5 mm long, keeled beneath, rarely somewhat subulate and spreading; the twigs sometimes dilated at the apex into a pinnate portion with the leaves thicker-coriaceous than in young plants. Male flowers terminal on short lateral twigs, 2—3.5 cm long, bearing acute scale-like leaves, cylindrical, 7—12 mm long by 2 mm in diam.; stamens with large, triangular, acute, keeled apiculus; pollen grains with 3 air bladders. Female flowers terminal on short, often nutant lateral twigs bearing short, scale-like leaves, which often are slightly larger towards the extremity and there forming an involucre of subulate usually nearly quadrangular or slightly laterally flattened sterile leaves which are abruptly acuminate into a fine mucro; receptacle composed of 2 or more fleshy leaf-bases, the sterile ones of which bear a short, cylindrical, slightly flattened, obtuse, free lamina; the fertile one, or sometimes two, with an oblong carpid. Fruit-bearing twigs 3—15 mm long; involucral leaves below the ripe fruit horizontally spreading 2.5—4 mm, rarely up to 5 mm long; receptacle short-cylindrical or slightly obconical, 3—4 mm long and in diam., warty; sterile laminae up to 3 mm long. Seed subglobose, rarely slightly narrowed towards the apex, obtuse, 4—6 mm in diam., erect or somewhat oblique, often with slightly prominent rib on the back and with slightly prominent margin of the carpid at the apex. (Description from all the collections mentioned below.) Cfr. *Fig. 2; Plate IV, 2.*

P. imbricata is a tree up to 60 m tall (according to Junghuhn, 1851, p. 509, foot-note, this is exaggerated). The bole is usually columnal, terete, to 2 m in diam., and without buttresses or with small ones; the crown is usually highly attached and is thin. The bark is reddish (Bangham 1074), dark-brown (Koorders 1270, Boschpr. b.b. 8532, b.b. 15504 and b.b. 5460), dark brownish-black (Koorders 1271), dark grey (Koorders 1274) or grey (Koorders 1269). The wood is light red (Boschpr. b.b. 8532, b.d. 5460), yellow (b.b. 15504), or brown, not citrine (Endert 3682). The bark is said to yield some resin (Boschpr. b.b. 5543), colourless sap (b.b. 8532, Ja. 1925, b.b. 19559), a little white sap (b.b. 7708 and b.b. 11629), a little red sap (b.b. 6934), or a little light red sap (b.b. 12602). The male flower is green (Bünnemeijer 4340) or reddish green (b.b. 23538). The fruit is green (Clemens 33618 and 51635, Koorders 27705), yellow-green (Boschpr. 15504), or red (b.b. 5443. Sapiin s. n., Koorders 1279 and 1281, Clemens 3323).

According to statements by different authors the receptacle is red (Brandis, l. c., Delsman, l. c.), or yellow-green, purple later (Pilger, 1903, l. c.), and the seed is red (Brandis, l. c., Koorders and Valeton, 1904, l. c., Van Eeden, 1906, l. c., Ridley, 1911, l. c.). The bark is reddish (Koorders and Valeton, l. c., Van Eeden, l. c.), or reddish-brown (Koorders, 1911 l. c., Ridley, 1903, l. c.), greyish brown or light yellow (Burkill, l. c.), greyish-yellow or light greyish-brown or yellow (Heyne, l. c.).

P. imbricata occurs in primary and secondary forests from 700 m up to about 3000 m el., but especially between 1000 and 2000 m el. (according to Koorders and Valeton, l. c., in Java especially between 1400 and 1750 m el.). At this altitude the specimens usually grow scattered, whereas the columnal boles raise their crowns to above the canopy of the forest. Yet, also above 2500 m el. there occur 15—20 m tall trees (Mt. Kinabalu, Clemens 33618, Celebes, Boschpr. b.b. 15155, and Kjellberg 3792). From the New Hebrides I saw a collection from only 165 m el. Moreover, *P. imbricata* is cultivated as an ornamental tree, and is, at present, much planted for reafforestation.

The pinnate twigs are usually not branched and have a limited growth; it seems likely, that they will be shed as a whole.

Some plants from the Malay Peninsula and Sumatra have the leaves on the fertile twigs much coarser, less scale-like, longer and narrower, slightly spreading and often slightly falcate, *e. g.* the collections For. Dep. F. M. S. 22563 and 28284, Kelsall 1984, Boschpr. b.b. 4130, and b.b. 2436. Also the specimen Endert 3682, from Borneo, has the leaves coarser and somewhat spreading, but the female flowers are entirely typical. The leaves of Bur. Sci. 10829, from Luzon, are somewhat more subulate. On the other hand, there occur plants with the scale-like leaves finer, slightly spreading, strongly keeled on the back, and often more or less convex above, *e. g.*, Lörzing 8936, b.b. 7708, Bünnemeijer 4340, and De Voogd 119, all from Sumatra, Bur. Sci. 8328 from Luzon, and Boschpr. b.b. 23538 from Celebes. Also the leaves of Carr 13264, from New Guinea, are somewhat spreading, whereas the 2—6 cm long and 4—6 mm broad, terminal, pinnate twigs are linear in outline. I have also included the specimen Gjellerup 1148, from New Guinea, in this species, though it strongly deviates as regards the foliage; the short, subulate leaves are rather strongly spreading and this points somewhat towards *P. papuana*; the fruits, however, are entirely typical.

The specimens Sing. Field no. 27010, Clemens 28631 and 29779, all from Mt. Kinabalu at ca. 5000 ft el., are 30—100 ft tall trees of normal

shape and foliage. The specimens Sing. Field no. 27735 and 27553, from 6500 ft. el., and Clemens 33618 and 51635, from 8000 ft el., however, are in some respects intermediary between the former specimens and the var. *kinabaluensis*, especially as regards the foliage. The sterile leaves below the fruit are strongly laterally flattened, but straight or very slightly falcate, nearly horizontally spreading, and nearly 5 mm long. The seed, however, shows the typical shape.

In *P. imbricata* the sterile leaves below the very young female flowers are perhaps always erect and envelop the flower entirely or for a great part. Below the ripe fruit, however, they are nearly always horizontally spreading and usually subquadrangular or slightly laterally flattened. By these characters the species may be distinguished from all other species and varieties, with the exception of *P. papuana*.

The receptacle, which is usually composed of 2 fleshy bracts, sometimes is composed of more numerous, scattered bracts, of which sometimes 2 are fertile. The sterile parts, which usually are of a different length, mostly bear a free, short lamina each. In such cases the two fertile scales are not exactly opposite, but sometimes more obliquely so, which reveals the spiral structure of the receptacle.

Malay Peninsula. Kedah: Kedah Peak, 1000 m el., *For. Departm.* F. M. S. Field no. 13654 coll. *Watson* (S, s); *Low* (ex *Ridley* 1925, l. c.); *Griffith* (ex *Ridley* 1911, l. c.); Penang: *Wallich, Maingay* (ex *Hooker* 1888, l. c.); Penang Hill, *Curtis* (ex *Ridley* 1911, l. c.); Perak: Cameron's Highlands, Tapah, *For. Departm.* F. M. S. Field no. 10937 coll. *Henderson* (S, m); G. Batu Putih, *Wray* (ex *Ridley* 1925, l. c.); Pahang: Fraser Hill, *For. Departm.* F. M. S. Field no. 22563 coll. *Deris,* v.n.: ru (S, f); Kluang Terbang, *Barnes* 10907 (S, f); G. Tahan, by the Teku (ex *Ridley* 1915, l. c.); S. Telom, 900 m el., *Sing.* Field no. 23931 coll. *Strugnell* (B, s); S. Gesoh, *For. Dep.* F. M. S. Field no. 28284 coll. *Dolman,* v.n.: ru bukit (S, f); P. Tioman, G. Kajang, 1100 m el., *Sing.* Field no. 18608 coll. *Md. Nur* (S, s); Selangor: Bukit Hitam, *Kelsall* 1984 (S, s); Semangkok Pass, *Ridley* 8635 (ex *Ridley* 1911, l. c.); Batang Padang, Pahang Track, Semangkok Pass, *Burn Murdoch* 11964 (S, s); Johore: G. Pulai, *Ridley* 3716 (S, f).

Sumatra. Atjeh: Boer-ni-Lintang, 1800 m el., *Van Steenis* 6290 (B, s); Gajolanden, from bivouac K. Kapi and K. Aoenan to bivouac Paja, 1100—1250 m el., *Van Steenis* 9957 (B, s); G. Kemiri, 3300—2850 m el., *Van Steenis* 9712 (B, s); Gajo- en Alaslanden, Gajo Loceüs, G. Paragan, *Pringgo Atmodjo* 82 & 90 partly (B, L, s); Oostkust (E. coast): near Pantjarbatoe, E. foot of the Siboeatan, 1400 m el., *Lörzing* 7117, v.n.: sampinoer boenga (B, L, f); above Bandarbaroe, 1200—1300 m el., *Lörzing* 6676 (B, s); Dolok Singgalang, 1800 m el., *Lörzing* 8936 (B, f); near Piso-piso, 1350—1500 m el., *Bangham* 1074 (S, s); *Bangham* 1127 (ex *Merrill* 1934, l. c.); Siosar, 1575 m el., *Lörzing* 8627 (B, L, s); Sibajak, 1900 m el., *Lörzing* 8299 (B, s); subdiv. Karolanden, Sigoeroenggoeroeng, on the Laoet Kawar, 1500 m el., *Boschproefstation* b.b. 5443, v.n.: beroe, sampinoer boenga (B, L, f); Pantjoerbatoe, res. Siboeatan, 1400 m el., *Boschpr.* b.b. 2768, v.n.: sam-

pinoer boenga (B, L, f); b.b. 7708 (B, L, f); Tongkoh, 1800 m el., *Boschpr.* b.b. 6235, v.n.: kajoe roe (B, s); subdiv. Simeloengoen, Marehat Hoeta, 700 m el., *Boschpr.* b.b. 4866, v.n.: sapinoer damanik (B, L, s); Girsang, 1200 m el., *Boschpr.* b.b. 8532, v.n.: sapinoer boenga (B, s); Simeloengoen, *Yates* 2148 (B, L, s); Berastagi, *Yates* 1987 (L, S, s); Tinggiradja, *Jochems* 24 (B, s); Tapiannoeli: Loeboekraja, 1000—1300 m el., *Junghuhn* s.n. (L, s); 1600—1900 m el., *Junghuhn* s.n. (L, s); Westkust (W. coast): Alahanpandjang, *Teysmann* 518 H. B., v.n.: kayoe ambo (B, U, s); Padangsche Bovenlanden, G. Singgalang, *Beccari* P. S. 49 (L, s); 2500 m el., *Schiffner* 1474 (L, f); 1700 m el., *Schiffner* 1473 (L, s); G. Pago, 1400 m el., *Bünnemeijer* 4340 (B, f); id., 2000 m el., thicket, *Bünnemeijer* 4022 (B, s); subdiv. Solok, Loeboeksoelasih, res. Airtaroesan, 1000 m el., *Boschpr.* 4130, v.n.: kajoe amboen (B, L, U, W, s); subdiv. Kerintji Indrapoera, Air Lebo, 1200 m el., *Boschpr.* b.b. 18752, v.n.: kajoe emboen (B, S, s); G. Kerintji, Siolok Daras, 1000 m el., *Ridley* (ex *Ridley* 1917, l.c.); Bengkoeloe: subdiv. Redjang, near ds. Airdingin, Paja Magelang, *Boschpr.* b.b. 2436 (B, L, s); subdiv. Kroeï, Waimengakoe, 950 m el., *Boschpr.* b.b. 8737, v.n.: talas (B, L, U, s); G. Pesagi, 1700 m el., Rappard P. 19 (B, s); G. Pesagi, Liwa, 1800 m el., *De Voogd* 119 (B, s); 1700 m el., *De Voogd* 134 (B, s); Palembang: subdiv. Pasemahlanden, Pg. Meroenggang, marga Boemiagoeng, slope of the G. Dempo, *Boschpr.* T. B. 449, v.n.: roe (B, f); G. Seminoeng, 1800 m el., *Rappard* S. 28 (B, s); near summit of G. Pesagi, 2000 m el., *Van Steenis* 3695 (B, s).

Borneo. British North Borneo: Mt. Kinabalu, E. of Lodge, 1650 m el., *Clemens* 29779 (B, L, s); *Clemens* 28631 (B, L, S, s); path to Ranau, 1600 m el., *Sing.* Field No. 27010 coll. *Carr* (S, f); Kadamaian River, 2150 m el., *Sing.* Field No. 27735 coll. *Carr* (S, f); main spur below Kamborangah, 2150 m el., *Sing.* Field No. 27553 coll. *Carr* (S, f); above Panataran Basin, 2600 m el., *Clemens* 33618 (B, L, f); Masilau River, 2600 m el., *Clemens 51635* (L, f); Sarawak: *Moulton*; *Foxworthy* (ex *Merrill* 1921, l.c.); G. Wah, 700 m el., and G. Poë, 1150 m el., *Beccari* (ex *Parlatore* 1868, l.c.); Kapit, Upper Rejang River, *Clemens* 21066, cultivated (B, s); Western part: G. Damoes, *Hallier* B. 458 (B, s); Southern Part: without exact locality, prob. G. Sakoembang, *Korthals* s.n. (G, L, f); G. Sakoembang, *Korthals* s.n. (L, s); Eastern Part: West Koetai, near Kong Kemoel, 1100 m el., *Endert* 3682 (B, f).

Java. Without exact locality: *Blume* s.n. (L, f); *Wichura* 2237 (ex *Pilger* 1903, l.c.); *Junghuhn* s.n., v.n.: kimerak (B, L, U, s); *Korthals* s.n. (L, s); *Waitz* s.n. (L, s); *Waitz* s.n., seedling (L, s); W. Java: Nirmala, 1200—1500 m el., *Backer* 11050 (B, s); G. Salak, *Koorders* 24182, v.n.: kitjamara (B, L, s); *Zollinger* 2229 or 2262 (U, f); G. Gadjah, 1500 m el., *Bakhuizen van den Brink fil.* 726 (U, s); G. Tjisalak above Tjitjoeroeg, *Bakhuizen van den Brink fil.* 2553 (U, s); G. Gedé, *De Vriese* s.n. (L, f); between Tjipanas and Tjibodas, 1500 m el., *Hallier* 427 (B, f); Tjibodas, 1400—1500 m el., *Sapiin* s.n., v.n.: kipoetri (B, f); *Raap* 713 (L, f); *Sapei* 147 (B, f); *Hallier* 653 (B, s); *De Monchy* s.n. (B, L, s); *Danser* 5886 (G, s); *Backer* 31326 (B, m); *Van Steenis* 1882 (B, s); *Koorders* for. no. 3053a, herb. no. 1270, v.n.: *kitjamara* (B, L, f), 12618 (B, f); 15582 (B, f), 41790 (B, s); for. no. 3073a, herb. no. 1271, v.n.: kipoetri (B, f), 1272 (B, s), 12608 (B, f); for. no. 3090a, herb. no. 1273, v.n.: kipoetri (B, L, s), 12599 (B, f), 41820 (B, s); for. no. 3127a, herb. no. 1274, v.n.: kitjamara (B, W, s), 12581 (B, s), 41843 (B, s); for. no. 3276a, herb. no. 25922 (B, L, f), 41951 (B, f); for. no. 3312a, herb.

no. 25819, v.n.: kibima (B, s); for. no. 3342a, herb. no. 41972 (B, s); for. no. 2578*, herb. no. 37111 (B, s); 1600 m el., *Koorders* 39364, v.n.: kipoetri (B, s); forest G. Poetri, *Koorders* for. no. 3243*, herb. no. 14321 (B, s); forest Rawahpandjang, *Koorders* for. no. 3295a, herb. no. 15534, v.n.: kitjamara, kipoetri (B, L, s); G. Gedé, S. slope, 1800 m el., *Backer* 14742 (B, s); 2400 m el., *Backer* 3358, v.n.: kipoetri (B, s); Tjibeureum, *Arsin* 19690 (B, s); *Schiffner* 1475 (L, f); way to the hot springs, *Boerlage*, s. n., v.n.: kipoetri (B, L, f); way to Kandang Badak, 2390 m el., *Bruggeman* 3716 (B, s); Kandang Badak, *Burck* s. n., v.n.: kibima (B, s); above Kandang Badak, 2500—2550 m el., *Backer* 31376 (B, s); G. Pangranggo, *Kuhl & Van Hasselt* s. n. (L, s); 2900 m el., *Palmer & Bryant* 988 (S, s); Gegerbintang, *Koorders* for. no. 3233a, herb. no. 14323, v.n.: kipoetri (B, s), 41921 (B, f); 1500 m el., *Den Berger* 549, v.n.: kipoetri (B, L, s); 2000 m el., *Den Berger* 637 (B, m); G. Boerangrang, N. Slope, 1500—1600 m el., *Backer* 14329 (B, s); 1800 m el., *Bakhuizen van den Brink* 4606 (B, s); Pasir Kohok, 1220 m el., *Bakhuizen van den Brink* 4422 (B, s); G. Tangkoebanprahoe, *Scheffer* s. n., v.n.: djamoedjoe (B, f); above Lembang, *Junghuhn* s. n. (L, f); Bandoeng, *Junghuhn* s. n., v.n.: kitjamara (L, f); "Kina-Bandoeng", *Scheffer* s. n., v.n.: jamoedjoe (B, s); reg. Bandoeng, forest garden G-F, 2000 m el., *Boschproefstation* Ja. 4001, v.n.: djamoedjoe (B, s); 2100 m el., *Boschpr.* Ja. 3986 (B, s); Takokak, Djampangwètan, 1150 m el., *Koorders* 1277 (B, s); for. no. 2019*, herb. no. 27704, v.n.: tjemara (B, L, s); for. no. 2396*, herb. no. 15535, v.n.: tjamara (B, L, f); Goenoeng Rosa, S. of Lampegan, 1200 m el., *Leefmans* s. n. (B, s); Tjigoea, S. of Tjireunghas, 1150—1200 m el., *Backer* 15121 (B, s); G. Bèsèr, 1100 m el., *Winckel* s. n., v.n.: kihadji (L, s); *Bakhuizen van den Brink* 740, v.n.: kihadji (B, s); 1300 m el., *Bakhuizen van den Brink* 1936, v.n.: kihadji (B, L, s); *Backer* 22582 (B, s); Tjempaka, S. of Tjibeber, 1100 m el., planted along the road, *Backer* 23017 (B, s); *Bakhuizen van den Brink* 1811 (B, L, s); reg. Bandoeng, Datarpoespa, 1700 m el., *Boschpr.* Ja. 1925, v.n.: djamoedjoe (B, s); Tjigenteng, *Koorders* for. no. 2170a, herb. no. 1269, v.n.: djamoedjoe (B, m); *Koorders* 1276 (B, f); Pengalengan, 1500 m el., *Opziener* Pengalengan XIII, v.n.: djamoedjoe (W, f); G. Tiloe, *Warburg* 11119 (ex *Warburg* 1900, l. c.); G. Malabar, 1800 m el., *Pulle* s. n. (B, U, s); G. Patoeha, Telaga Patengan, *Junghuhn* s. n. (L, s); G. Kendang, 1000—2000 m el., *Junghuhn* s. n. (L, s); G. Kendang. Kawah Manoek, *Van Rijckevorsel* 66 (B, s); G. Tjikoerai, above Waspada, 1800 m el., *Backer* 5406 (B, s); G. Oeroeg, *Smith & Rant* 350 (B, f); G. Telagabodas, *Boerlage* s. n. (L, s); Pangentjongan, *Koorders* 1275 (B, L, s); 14159 (B, f); Forest Pasirbingking, *Koorders* for. no. 2433aa, herb. no. 14122, v.n.: kihades (B, s); forest Pasirkaboejoetan, 1500 m el., *Koorders* 14141, v.n.: kihades (B, L, f); Pangentjongan, N.W. G. Gloengoeng, 1400 m el., *Koorders* 1299, v.n.: kihades ,B, s); Noesagedé, in the Pendjaloe Lake, 720 m el., *Koorders* for. no. 705*, herb. no. 44321, v.n.: kitjemara (B, s); G. Tjerimai, *Van der Meer Mohr* 9 (B, s); *Vermeulen* 50 (B, s); 1650—2000 m el., *Junghuhn* s. n. (L, s); above Linggandjati, 1500 m el., *Backer* 4922 (B, s); Koeningan, *Houter* 14, v.n.: kidjamoedjoe (B, s); Central Java: G. Slamet, *De Boer* 6603 (B, f); 2240 and more m el., *Backer* 461 (B, s); 1800 m el., *Brascamp* 18, v.n.: tjemara (B, L, s); forest Bentjana, 1400—1500 m el.; *Koorders* 1286, v.n.: tjemara (B, s); G. Ragadjambangan, 2100 m el., *Backer* 16157 (B, s); G. Prahoe, 2550 m el., *Koorders* 11246 (B, s); *Backer* 21819 (B, s); above Soerdja, 1400 m el., *Koorders* 1287, v.n.: tjemara (B, s); G. Diëng, *Junghuhn* s. n., v.n.: tjamara (L, s); G. Kembang, near Badakas, 2200 m el., *Koorders* 10906 (B, s);

G. Soendara, 1700 m el., *Koorders* 11280, planted, v.n.: tjemara (B, s); G. Oengaran, 1000—1350 m el., *Junghuhn* s. n. (L, s); *Koorders* for. no. 2380i, herb. no. 1283, v.n.: tjemara rante (B, L, s); for. no. 2423i, herb. no. 1284 (B, L, s); for. no. 3041i, herb. no. 1285, v.n.: tjemara (B, L, s); for. no. 728*. herb. no. 27705, v.n.: tjemara godong (B, L, W, f); Telamojo, 1400 m el., *Koorders* for. no. 2328*, herb. no. 35782, v.n.: tjemara (B, s); East Java: G. Lawoe, *Diepenhorst* s. n. (L, s); near Sarangan, 1600 m el., *Dorgelo* S. 248, v. n.: pohon aroeh (Pa, s); 1433 m el., *De Raat* s. n. (B, s); G. Koekoesan, 1500—1700 m el., *Elbert* 52 (L, s); G. Wilis, 1500 m el., *Lörzing* 868, v.n.: tjemara waris (B, s); Ngebel, 1450 m el., *Koorders* for. no. 2050f, herb. no. 1278, v.n.: tjemara toekoeng (B, L, s), 38699, v.n.: tjemara (B, s); for. no. 2120f, herb. no. 1279β, v.n.: tjemara tikoeng (B, L, s), 29188, v.n.: tjemara (B, L, s), 38652 (B, L, s); for. no. 2126f, herb. no. 1280 (B, L, f), 1281 & 1282, v.n.: tjemoro toekoeng, tjemara tikoeng (B, L, f); 38626, v.n.: tjemara (B, L, s); for. no. 362*, herb. no. 29189, v.n.: tjemara tikoeng (B, f); G. Wilis above Poedok, 1700 m el., *Koorders* 1288, v.n.: tadji (B, s); G. Wilis-Boetak, *Warburg* 3512 (ex *Warburg* 1900, l. c.); Toeloengagoeng, Gondanggoenoeng, 1900 m el., *Boschpr.* Ja. 3614 (B, s); G. Andjasmoro, above Segoenoeng, 1500—1900 m el., *Winckel* s. n. (B, s); G. Kawi, above Poedjon, *Burger* 6336, v.n.: tjemara (B, f); G. Dorowati, 1400—1500 m el., *Backer* s. n. (B, s); G. Koekoesan, 1600 m el., *Bijhouwer* 105 (B, s); G. Ardjoeno, *Zollinger* 2229 or 2262 (U, s, f); 2100—2400 m el., *Koorders* for. no. 1863*, herb. no. 38188 (B, s); for. no. 1985*, herb. no. 38187 (B, L, f); G. Tengger, *Horsfield* (ex *Bennett* 1838, l. c.); *Mousset* 334 (B, s); near Ngadasari, 2000 m el., *Koorders* 37922, v.n.: hroeh, aroeh (B, L, s); forest Sekarkoening, 1700 m el., *Koorders* for. no. 2056*, herb. no. 37923, v.n.: aroeh (B, L, s); Ngadiwono, 1600 m el., *Siegel* s. n. in Herb. *Kobus* s. n. (B, s); above Tosari, 2000 m el., *Leefmans* 31 (B, s); G. Smeroe, S. slope, Ranoe Daroengan, 1000 m el., *Bijhouwer* 222 (B, s); G. Ijang, *Van Dillewijn* 175 (Pa, s); 900—2200 m el., *Snepvangers* s. n. (B, f); 2300 m el., *Koorders* 43663 (B, s); N.E. slope 1300 and more m el., rain forest and tjemara forest, *Backer* 9604 (B, s); *Jeswiet* 257 (B, s); Tjemoro Lantjang, 2200 m el., *Jeswiet* & *Hagedoorn* 450 (B, s); W. slope, Bermi to Taman Hidoep, 1600—2000 m el., *Van Steenis* 10812, v.n.: kadjoe pokis, tjemara bineh (B, f); G. Raëng, Soemberwringin, 1650 m el., *Clason-Laarman* 184 (G, s); Idjen Plateau, 1700 m el., *Koorders* 1292 (B, s); 1294 (B, f); for. no. 9401t, herb. no. 1289 (B, f); for. no. 9408t, herb. no. 1290 (B, L, s); for. no. 9412t, herb. no. 1291 (B, s), 28505 (B, s); for. no. 9431t, herb. no. 1293 (B, f); for. no. 9432t, herb. no. 1295 (B, f); Pantjoer Idjen, forest G. Kendeng, 1700 m el., *Koorders* 1298, v.n.: tjemoro bini (B, s); for. no. 885*, herb. no. 28507, v.n.: tjoemara (B, f); path from Litjin to Oengoepoengoep, Rogodjampi, *Koorders* 1296 (B, L, f).

LESSER SUNDA ISLANDS. Bali: B. Batoekaoe, 1930 m el., *Sarip* (Exp. *Maier*) 371, v.n.: taroepanda (B, L, s); subdiv. Boeleleng, Tambokan, 1400 m el., *Boschpr.* b.b. 11629, v.n.: tjemara pendek (B, s); 1300 m el., *Boschpr.* b.b. 17269, v.n.: tjemara pandak (B, s); Lombok: G. Rindjani, Sangkareang, S.S.E. slope, 700—1700 m el., *Gründler* (Exp. *Elbert*) 2266 (L, s); Plambi, 200—400 m el., *Gründler* 2428 (ex *Hallier* 1912, l. c.); subdiv. Central Lombok, Lenek, 700 m el., *Boschpr.* b.b. 15504, v.n.: majangmekar (B, L, f); Soembawa: G. Batoelanteh, N. slope, 1500—1700 m el., *Gründler* (Exp. *Elbert*) 4191 (L, s); 1600 m el., Batoedoelang, *Boschpr.* b.b. 6934, v.n.: bage (B, s); 1000—1200 m el., *Rensch* 692 (L, s); Soemba: subdiv. Central & East Soemba, Laironda, 1000 m el., *Boschpr.* b.b. 9003, v.n.: kadjoe oeamang (B,

L, U, s); *Iboet* 547, v.n.: kadjoe oewana (B, L, s); Flores: G. Kasteru, N.W. slope, 1800 m el., *Posthumus* 3235 (B, L, s); Rana Mesé, 1300 m el., *Rensch* 1162, 1307 (B, s); subdiv. Maoesnere, G. Hangamanoe, 1600 m el., *Boschpr.* b.b. 6904, v.n.: mboe (B, s); subdiv. Ende, Walo Lele, 1000 m el., *Boschpr.* b.b. 12602, v.n.: peto (B, s); Timor: *Forbes* 3855 (B, L, s); G. Moetis (*De Voogd* 1938, l. c.); subdiv. South Central Timor, Nenas, 1600 m el., *Boschpr.* b.b. 11803, v.n. haoe toeni (B, L, f).

PHILIPPINES. Luzon: Benguet prov., *For. Bureau* 10829 coll. *Curran* (B, L, s); *Clemens* 16251d (S, s); Mt. Santo Tomas, *Elmer* 6551 (B, f); Pauai, 2100 m el., *Bur. Sci.* 8328 coll. *MacGregor* (B, f); 2300 m el., *Bur.* Sci. 4405 coll. *Mearns* (L, S, f); distr. Lepanto, Mt. Data, *Elmer* 4546 (L, s); *For. Bureau* 14498 coll. *Darling* (L, s); prov. Tayabas, Mt. Banajao, *Weiss* 3820 partly (B, f); Bontoc subprov.; Abra prov., Zambales prov.; Mindoro; Negros (all *Foxworthy* 1911, l. c., but probably partly *P. Cumingii*); Mindanao: prov. Misamis, Mt. Malindang, *For. Bureau* 4666 coll. *Mearns* & *Hutchinson* (B, L, S, s); Zamboanga distr. (ex *Foxworthy* 1911, l. c.); Davao distr., Mt. Apo, *Schadenberg* (ex *Warburg*, 1900, l. c.); Mt. Dagatpan, *Warburg* 14721 (ex *Warburg* 1900, l. c.).

CELEBES. Subdiv. Paloe, Woeka Tampai, 2500 m el., *Boschpr.* b.b. 15155, v.n.: siori (B, L, s); subdiv. Poso, Lake Poso, 2000 m el., *Boschpr.* b.b. 14898 (B, s); Central Celebes, Boeloe Palaka, *Abendanon* s. n. (B, f); subdiv. Upper Binoeang, Talamanti, *Boschpr.* b.b. 20202, v.n.: sarre (B, s); subdiv. Makale-Rantepao, Doa (Baloesoe), 1150 m el., *Boschpr.* b.b. 21274, v.n.: sapoeko pangala (B, s); subdiv. Palopo, To Lemo, 2300 m el., *Boschpr.* b.b. 23538, v.n. angin-angin (B, m); subdiv. Masamba, Taladoe, 1300 m el., *Boschpr.* b.b. 24173 (B, s); subdiv. Malili, 1500 m el., *Boschpr.* b.b. 24209, v.n.: angin (B, s); Porehoe, 1200 m el., *Boschpr.* b.b. 19559, v.n.: angin-angin (B, s); 1500 m el., *Boschpr.* b.b. 19563, v.n.: angin-angin (B, f); subdiv. Bantaèng, Paringtalasa, 2000 m el., *Boschpr.* b.b. 5460, v.n.: kajoe angin (B, L, f); G, Bantaèng, *Everett* 42 (B, s); 2060 m el., *Bünnemeÿer* 12019, v.n.: kajoe parang (B, L, U, f); 2200 m el., *Bünnemeÿer* 11855 (B, s); 11977, v.n.: kajoe parang (B, f); 2300 m el., *Bünnemeÿer* 11903 (B, L, s); Bantaèng, Lanjienga, 1500 m el., *Teysmann* 13984, v.n.: tjamba-tjamba (B, f); *Teysmann* 13988, v.n.: kajoe angien (B, f); Wawo-Kraèng, *Warburg* 16892; near Manipi, *Warburg* 16432, 2000 m el., *Sarasin* 1263a, Lompobatang, 2000 m el., *Sarasin* 1263b (all ex *Warburg* 1900, l. c.); S.E. Celebes, Poka Pindjang, 2700—3000 m el., *Kjellberg* 3792 (B, f).

MOLUCCAS. Batjan: G. Sibéla (ex *Warburg* 1900, l. c.); Boeroe, Fakal, 1100 m el., *Toxopeus* 485 (B, L, s).

NEW GUINEA. N.W. Part: Arfak Mts., Angi Lake, 1900 m el., *Gjelllerup* 1148 (B, f); ridge to Doorman Top, 2650 m el., *Lam* 2160 (B, s); S.W. Part: Hellwig Mts., *von Römer* 746 (B, L, s), 751 (B, s); 1350 m el., *von Römer* 1022 (ex *Koorders* 1914, l. c.); N.E. Part: Mt. Sarawaket (ex *Lane-Poole*, 1925, l. c.); Morobe Distr., Ogeramnang, 1960 m el., *Clemens* 5473 (BD, s); Yunzaing, 1530 m el., *Clemens* 3323 (BD, f); S.E. Part: Alola, 2000 m el., *Carr* 14194 (L, f); Boridi, 1550 m el., *Carr* 13264 (BD, L, s); Mt. Knutsford, *MacGregor*; Mt. Obree, 2300 m el., *Sayer* (both ex *Koorders* 1914, l. c.); Mt. Obree, *Lane-Poole* 259 & 554 (ex *Lane-Poole* 1925, l. c.); Mt. Scratchley, 3300—3400 m el., *MacGregor*; Wharton Range, 3300 m el., *MacGregor* (ex Kew Bull. 1899, l. c.); Central Division, Wharton

Range, Murray Pass, 2840 m el., *Brass* 4768 (BD, s); Mt. Tafa, 2400 m el., *Brass* 5115 (BD, s).

BISMARCK ARCHIPELAGO. New Ireland (Neu-Mecklenburg), Namatanai, near Butam, 1000 m el., *Peekel* 588 (BD, s).

NEW HEBRIDES. Aneityum Island: Anelgauhat Bay, 170 m el., *Kajewski* 849 (B, f).

Cultivated: in the Botanic Garden, Singapore (S, m, f, s); in the Botanic Garden Sibolangit, no. 23 (B, s); in the Bot. Garden Buitenzorg no. V. F. 24, from Sumatra (B, m); V. F. 28, from Java (B, f, G, Pa, s); X. B. 24, from unknown provenance (B, s); XI. B. XVI, 56, from Java (B, s).

Further distribution: Upper Burma (ex *Hooker* 1888), French Indo-China: Tonkin, Annam, Laos, Cambodia (ex *Hickel* 1931), China: Kwantung, Kwangsi (ex *Hu* 1934), Hainan, *How* 72870 (B, f); New Caledonia? (ex *Stapf* 1914), and Fiji Islands (ex *Gibbs* 1914).

P. imbricata var. β **curvula** (Miquel) Wasscher, n. comb. — *Podocarpus cupressina* R. Brown var. *curvula* Miquel, Pl. Junghuhn., 1 (1851) 4; Fl. Ind. Bat., II, 6 (1859) 1074. — *Dacrydium* sp. Van Steenis, in Tijdschr. Kon. Ned. Aardr. Gen., 55 (1938) 762, 764, 772, 781, phot. 6, see below.

All twigs usually curved towards one side, stouter and thicker than in the main form of the species, the leafy twigs 1—2 mm in diam. Leaves scale-like or slightly subulate, thick, nearly adpressed, 1.5—4 mm long, flat above, strongly keeled beneath; young terminal shoots sometimes with thinner, to 4 mm long, often somewhat spreading leaves; pinnate twigs as in the main form of the species. Male flowers on short, straight, 1.5—12 mm long lateral twigs with normal, scale-like or slightly subulate leaves, short-cylindrical, 6—15 mm long, 2.5—3.5 mm in diam.; stamens with ovate-triangular, finely acuminate, 1 mm long and 0.5 mm broad apiculus; pollen grains with 3 air bladders. Female flowers on short, usually nutant lateral twigs with normal scale-like or somewhat subulate leaves; sterile leaves below the flowers subulate, erect, adpressed, dorsiventrally flattened, slightly rounded above, strongly keeled beneath; receptacle composed of 2 or 3 fleshy bracts, of which 1—2 fertile and 1—2 sterile; the apex of the carpid curved over the top of the ovule. Fruit-bearing twigs 3—15 mm long; sterile leaves below the fruit not spreading or only slightly so, up to 4.5 mm long; receptacle short-cylindrical, warty, 3—4 mm long and 2.5—3 mm broad; seed globose, rarely slightly narrowed towards the apex, 5—6.5 mm in diam., smooth, shining, slightly nerved on the back; free part of the apex of the carpid usually short, little or not prominent. (Description from the specimens mentioned below). Cfr. *Plate IV, 2β.*

The var. *curvula* is based by Miquel upon the different leaves and the shorter-petioled lateral male flowers, which, according to him, moreover have a different shape. Though the differential character of the shorter-petioled lateral male flowers does not exist, this variety, which is always overlooked by later authors, is rightly distinguished. It differs from the main form in the invariably curved-down twigs (expressed in Miquel's name), the much coarser foliage, the larger male flowers, the always erect, adpressed, dorsiventrally flattened sterile leaves below the fruit, and the usually short free apex of the carpid on the top of the seed.

According to herbarium labels, the plants from Java mentioned below are erect trees up to 30 m tall. The plants from Sumatra, however, are always small, up to 8 m tall, often procumbent trees. The variety occurs from 1350—3300 m el., but, with the exception of some of Junghuhn's specimens, all the collections are from elevations of 2000 m and more. The main form of species is said to occur from 700—3000 m, but mainly occurs between 1000 and 2000 m el. Though these elevations and those of the variety do not exclude each other, it yet seems possible, that the variety usually occurs at higher elevations than the species and takes the shrub-form on the exposed mountain summits. From observations by Junghuhn and other authors on the mountain flora, however, it appears that the question is not so simple. Junghuhn (Java, ed. 2, I, p. 509) says about the trees of *P. imbricata*, which occur at lower elevations, that they have a columnal shape and usually are growing scattered; about those from higher elevations, he writes (translated from the Dutch): "On those summits, however, they are growing gregariously, covering the steepest slopes and raising themselves pyramidally as young firs and juniper-trees. These pyramidal small trees are not taller than 10 to 20 feet, and have verticillate branches directed upward, of which the ...... young twigs grow downward." It does not seem impossible to me, that these social trees belong to the var. *curvula*, especially so since Schmucker l. c. writes, that also the specimens from the highest elevations preserve the typical tree-shape, though of course more compact and smaller than at lower elevations. Docters van Leeuwen (1933, p. 18) writes in respect to the mountain flora of Mt. Pangranggo-Gedé "Blaauw says that the low temperatures in these areas cause several species to die out after a reduction to dwarf form. This is, in my opinion, not correct: at the highest limits, reached by a species, very big individuals are sometimes met with, e. g. of *Podocarpus imbricata*." Speaking about of the forests of Junghuhn's

fourth zone he writes, however, that trees higher than 5 to 6 m are rare, whereas, moreover, they usually are branched more strongly towards the base, spreading the branches laterally, the trees in this way becoming more shrub-like. Among the trees composing the so-called "moss covered forests" he mentions also *Podocarpus imbricata*.

Taking into consideration all this, it does not seem impossible, that the shape of the tree is not the same on all mountain summits; on the other hand, it might be true, however, that the pyramidal trees always belong to the var. *curvula*, and that this variety does not occur on all mountains.

In his report of the expedition in the Gajo regions (1938), Van Steenis mentions this variety as "the weeping *Dacrydium*", a characteristic tree with dwarfy habit, and always low, sometimes appressed to the soil on windy localities in the mountains.

SUMATRA. Atjeh: Gajolanden, Poetjoek Angasan, 2600 m el., *Van Steenis* 8357 partly, v.n.: sangoe (B, s); *Van Steenis* 8380 (B, f); G. Leuser, upper course of the Lau Alas, 2100—2250 m el., *Van Steenis* 8423 (B, m, f); *Van Steenis* 8459 (B, s); Goh Lemboeh, summit, 2900—3050 m el., *Van Steenis* 8986 (B, f, m); G. Kemiri, E. slope, 2900—3314 m el., *Van Steenis* 9642, v.n.: sangoe (B, f).

JAVA. Without exact locality, *Junghuhn* s.n. (L, f); *Blume* s.n. (L, f); West Java: G. Gedé, 1350—2350 m el., *Junghuhn* s.n. (L, s); Pengalengan, 1350 m el., *Junghuhn* s.n. (L, U, f); G. Papandajan, 2200 m el., *Van Steenis* 4135, v.n.: djamoedjoe (B, f); Tegal Aloen-aloen, 2400 m el., *Van Steenis* 4778 (B, f); G. Tjerimai, 1650—2350 m el., *Junghuhn* s.n. (L, m); 2000 m el., *Docters van Leeuwen-Reijnvaan* 2529 (B, f); Central Java: Diëng Mts., G. Prahoe, *Junghuhn* s.n. (L, U, f, m); Kedoe, Wonosobo, *Zwart* 6517 (B, L, f); East Java: G. Kawi, Tjemorokandang, 2700 m el., *Docters van Leeuwen-Reijnvaan* 12264 (B, f); 2680—2780 m el., *Arens & Wurth* s.n. (B, s).

P. imbricata var. γ **kinabaluensis** Wasscher, n. var. — *Podocarpus cupressina* Stapf, in Transact. Linn. Soc., ser. 2, IV (1894) 249. — *Podocarpus imbricata* Gibbs, in Ann. Bot., 26 (1912) 525, p.p., t. 49, ic. 1—9; in Journ. Linn. Soc., 42 (1914) 35, 36, 41, p.p.; Stapf, in Journ. Linn. Soc., 42 (1914) 193 p.p.; Merrill, Bibl. En. Born. Pl. (1921) 31, p.p.

Ramuli erecti vel incurvati, minus dense foliati quam in speciei forma typica; folia nonnihil divergentia apice incurvata, strictissima, pungentia, sectione transversa subrhomboidea, 3—6 mm longa, in ramulis vetustioribus nonnunquam paulum dorsiventraliter applanata; folia in ramulorum partibus superioribus magis quinquefaria, divergentia, magis lateraliter applanata, 4—8 mm longa, suprema nonnunquam paulum pinnatim disposita; ramuli terminales iuveniles brevissimi, circiter 3—4 mm diametro foliis inclusis. Flores masculi ignoti. Flores

feminei terminales in ramulis lateralibus brevibus rectis, foliis receptaculum involucrantibus usque ad maturitatem erectis vel vix divergentibus, leviter lateraliter applanatis, falcatis, 5—8 mm longis, receptaculum et plerumque seminis partem inferiorem includentibus; semen 5—6 mm diametro, apice carpidii libero, ad 1 mm longo, supra apicem seminis curvato.

Twigs scattered, erect or upturned, much branched, very compact, with short, lateral twigs, less densely leaved than in the main form of the species, with the leaves slightly spreading with incurved apex, very rigid, pungent, subrhomboidal on transverse section, with slightly concave sides, 3—6 mm long, on older twigs sometimes slightly dorsiventrally flattened; the leaves in the upper parts of the twigs more exactly 5-farious, spreading, thick-coriaceous, slightly falcate, more laterally flattened, narrowly rhomboidal, with slightly concave sides, decurrent, 4—8 mm long; the uppermost ones sometimes somewhat pinnately arranged; young terminal shoots very short, densely leaved, about 3—4 mm in diam., with subulate, usually 3—4 mm long leaves. Male flowers unknown. Female flowers terminal on short, straight lateral twigs; leaves below the flowers gradually more erect or erect-spreading, slightly laterally flattened, narrowly rhomboidal; receptacle usually composed of 2 fleshy scales. Fruit-bearing twigs erect or slightly spreading. 7—16 mm long; sterile leaves below the fruit erect or erect-spreading also when ripe, falcate, 5—8 mm long, involving the receptacle and usually also the basal part of the seed; receptacle cylindrical or somewhat obconical, warty, 2—4 mm long and 2 mm in diam.; sterile lamina slightly flattened, 2½—3 mm long. Seed subglobose, 5—6 mm in diam., smooth, shining, with not or only slightly prominent rib; apex of the carpid free, curved over the seed, up to 1 mm long. (Description from all the specimens mentioned below.) Cfr. *Plate IV, 2 γ*.

According to herbarium labels, this variety is a small tree or shrub. The female flower is light-blue (Clemens 32316), the fruit purple (Clemens 27092—27854), dark-brown (Clemens 28910), blue (Clemens 29914), or brownish with pinkish red (Clemens 32316). The plant occurs on Mt. Kinabalu at high elevations up to the timberline in shrub-formations, of which it often represents the principal element, forming strongly compact, small, sometimes only 2 m high shrubs.

Though strongly deviating from the main form, these plants must be regarded as only a local form of *P. imbricata*. Also Gibbs (1912, l. c.) evidently regards them as a mountain form of this species, when

she writes: "A graceful forest tree, about 70 ft high, with straight trunk and compact crown...... It is a true mesophyllous mixed forest type, occurs always singly. As it runs up the exposed slopes of Kinabalu, however, it is finally, in the sclerophyllous dwarf forest subsummit zone, reduced to a compact shrub 5—6 ft high...... There the ultimate branches are erect, the terminal portion showing the cupressoid form of leaves, but arranged radially and five-seriate"; and further on: "The leaves subtending the strobilus pass gradually into the bracts of the latter and spread out round it in both the Fijian and Buitenzorg material, though not in that from the subsummit zone of Kinabalu". Indeed, this variety shows marked differences from the species in many respects, *e.g.*, in the much coarser, foliage, the numerous 5-farious, longer leaves towards the extremities of the twigs, the compact growth, the erect twigs, the shorter young terminal shoots, and especially in the erect or erect-spreading, longer, laterally flattened, sterile leaves below the fruit, and the free apex of the carpid on the top of the seed. There occur, however, on Mt. Kinabalu intermediates between the variety and the main form of the species (see the discussion of the main form above).

The specimen Haviland 1094 is a sterile branch with pinnate twigs, of nearly normal shape. The subulate leaves, however, are thick-coriaceous, 8—10 mm long by 1.25—1.5 mm broad. The pinnate twigs are 2.5—5 cm long by 13—19 mm broad.

BORNEO. British North Borneo: Mt. Kinabalu, 3600 m el., *Haviland* 1094 (S, s); *Haviland* 1095 (S, f); 3350 m el., *Holttum* s. n. (S, f); 2000—4000 m el., spur above Lobang to the granite cone, *Gibbs* 4166 (ex *Stapf* 1914, l. c.); 4260 m el., *Clemens* 27092—27854 (L, f); Paka Cave to Low's Peak, *Clemens* 10636 (B, f); above Paka, 3860 m el., *Clemens* 27854, type of the variety (B, f); Paka, 3600 m el., *Clemens* 28910 (B, L, f); at side of granite dome, 4030 m el., *Clemens* 29914 (B, L, f); Marai Parai, above Kamburangan, 3300—3600 m el., *Clemens* 32316 (B, L, f); 3600 m el., at highest timberline, *Clemens* 32317 (B, L, f); 3600 m el. *Clemens* 32318 (B, L, s); Paka Paka, 3350 m el., *Sing.* Field no. 28052 coll. *Carr* (S, f); Gurulau Spur, 3600 m el., *Clemens* 51201 (L, f).

3. **Podocarpus papuana** Ridley — *Podocarpus papuanus* Ridley, in Transact. Linn. Soc. London, IX, 1 (1916) 158; Gibbs, Contr. Arfak Mts. (1917) 80, ic. 4; Pilger, in Engler, Nat. Pfl. fam., ed. 2, 13 (1926) 245; Van Steenis, in Bull. Jard. Bot. Buitenz., sér. 3, vol. XIII, 2 (1934) 194; Florin, in Kungl. Svensk. Vet. Akad. Handl., X, 1 (1931) 267, 268; XIX, 2 (1940) 23.

Seedlings and young main twigs bearing pinnately leaved lateral twigs. Leaves of the main twigs adpressed, imbricate, thick-subulate, with the largest width just below the middle, narrowed towards the

base and decurrent, tapering into the acute, incurved apex, flat above, keeled beneath, concave at both sides of the keel, 2—2.5 mm long by 0.6 mm broad; leaves of the young extremities overtopping the pinnate twigs, more densely imbricate, smaller and less strongly keeled. Pinnately leaved lateral twigs narrowly ovate-lanceolate in outline, 22—30 mm long (in seedlings up to 40 mm) by 8—12 mm broad, the leaves bifarious, linear or sometimes more ovate, sligthly falcate, inserted on the twig with broad base, and decurrent on the twig, acuminate into the short incurved mucro, in adult trees thick-coriaceous, the longest ones 5—7 mm long by 1.25—1.5 mm broad, with slightly prominent midrib on both surfaces; the basal leaves of the twig imbricate, subulate. Fertile twigs not very densely branched, the twigs erect or spreading, their leaves strongly, sometimes nearly horizontally spreading, short- and very thick-subulate, with incurved apex and decurrent base, with the largest width somewhat below the middle, slightly narrowed towards the base, sessile on the twig with thick base, strongly decurrent, acuminate into the incurved mucro, triangular to quadrangular in section, strongly vaulted above, strongly keeled beneath, concave on both sides of the keel; moreover, some twigs with somewhat longer and more laterally flattened, quinquefarious leaves. Male flowers (according to Ridley) cylindrical, obtuse, 6 mm long by 2 mm in diam., with ovate, acute scales. Female flowers terminal on short lateral twigs with scale-like subulate leaves; sterile leaves below the receptacle straight, thick-subulate, quadrangular or slightly laterally flattened, abruptly shortly acuminate into a short incurved apiculus; receptacle composed of 2—4 leaf-bases, of which 1—2 fertile and 1—3 sterile, the sterile ones with often somewhat oblique carpid overtopping the ovule, the fertile ones with short, obtuse lamina. Fruit-bearing twigs up to 12 mm long; sterile leaves below the fruit horizontally spreading, 2.5—3 mm long; receptacle warty, cylindrical, the composing scales often clearly distinguishable, 3—4 mm long and 2.5—3 mm broad, the sterile scale often somewhat shorter; free, sterile lamina 1.5—2 mm long; seed subglobose, 5 mm in diam. (Description from the specimen Gibbs 5540.) Cfr. *Fig. 2; Plate IV, 3a, 3b.*

From Ridley's description it is not clear, whether it represents the same species as that described here. According to Ridley, *P. papuana* is allied to *P. imbricata*, but differs "(1) in the much thinner longer leaves of the sterile branches, which are much longer in proportion to their breadth than in *P. papuana*; (2) in the thick lanceolate short leaves of the fertile branches; (3) in the absence, as far as good series

of specimens show, of the slender whip-like fertile branches, so characteristic of this species. The seed is quite globose, without any point, and the male-flower scales are more ovate and thicker." Ridley's description is based upon two male specimens from Mt. Carstensz, collected by Kloss at 2500 ft and 8300—11000 ft el. respectively, and one female plant from Wharton Range, collected by Giulianetti at 11000 ft el. Moreover, the author includes in this species a specimen, collected by Burke between the south coast and the Owen Stanley Range, and the collections Lorentz 1698 and 1699 from the Hellwig mountains. The 2 latter plants were included in the genus *Dacrydium* by Koorders (Nova Guinea, VIII, 1, 1909, p. 177). Of the plants mentioned above, I only had the opportunity of examining Lorentz' collections. In my opinion, Lorentz 1699 belongs to *Podocarpus*, Lorentz 1698 to *Dacrydium* (in spite of the fact, that Koorders writes about these plants: "Ferner geht aus den Mitteilungen von Lorentz die wichtige Tatsache hervor, dass 'soweit erinnerlich', das gesamte Material von ihm von einem einzigen Baum gesammelt wurde"). According to Gibbs, Giulianetti's plant is no *P. papuana*, and must undoubtedly be included in *P. imbricata*. In my opinion Burke's collection should be included in *Dacrydium*, in accordance with the remarks given by Koorders, who says, that this plant has leaves up to 19 mm long, and agrees with "the form *D. Junghuhnii* from Sumatra". Gibbs has given a new description of the female plant, based upon the specimen Gibbs 5540 from the Arfak mountains, and a plant, collected by Beccari, likewise from the Arfak mountains (Hatam). According to her, the leaves of the seedlings and youth forms of *P. imbricata* and *P. papuana* are not different from each other. As regards the adult trees, she writes: "...... but the foliage of the mature tree is more spreading and distinct, the scales of the male cones differ in shape, while the female cones are larger and very glaucous in appearance. The fusion of the lamina of the fertile bract with the ovuligerous scale" (= ephimatium) "is also less complete than is the case in *P. imbricatus* and the position of the seed is more oblique". I had no opportunity of examining Beccari's plant; of the specimen Gibbs 5540 I saw a fragment, but without ripe seeds. This plant is closely allied to *P. imbricata*, but the foliage is very different. The sterile leaves below the fruit are here horizontally spreading as well, and have nearly the same shape as in *P. imbricata*. That the situation of the seed is oblique is not very important, since this sometimes also occurs in *P. imbricata*. Though I did not see Kloss' type-specimens, I here follow Gibbs in including

her collection in *P. papuana.* This specimen is from a "fine tree with pendant branches".

The specimen Lam 2159 only is a small fragment, picked up from the ground; the foliage entirely agrees with that of Gibbs 5540. The other three collections mentioned below are doubtful. Brass 4962, "a thick-boled tree, 15—20 m tall, with spreading crown of thinly foliaged branches", has both the rather strongly spreading subulate leaves, and the S-shaped curvation of the lower surface and the strongly vaulted upper surface, but much less distinctly so than Gibbs' plant, and, as regards the foliage, it more closely resembles the sterile twigs of this collection. Brass' collection also bears some terminal, pinnately leaved twigs up to 2.5 cm long and 7 mm broad. Perhaps also Lorentz 1699, a 15 m tall tree with a bole 60 cm in diam., must be included in this species, in spite of the deviating foliage. The leaves are much longer, up to 3.5 mm long, narrower, straighter, much less spreading and less rounded above. On the uppermost lateral twigs the leaves are nearly exactly quinquefarious and spreading, laterally flattened, and up to 4 mm long. The foliage of Lam 2153, a tree 15 m tall, is much like that of the preceding specimen, but here the greater deal of the twigs has quinquefarious leaves.

NEW GUINEA. N.W. Part: Arfak Mountains, Angi Lakes, 2300—3000 m el., *Gibbs* 5540 (B, f); ridge to Doormantop, 1460 m el., *Lam* 2159 (B, s).

Perhaps also:

NEW GUINEA. N.W. Part: ridge to Doormantop, 2550 m el., *Lam* 2153 (B, s); S.W. Part: Hellwig mountains, 2100 m el., *Lorentz* 1699 (B, L, U, s); S.E. Part: Central Division, Mt. Tafa, 2400 m el., *Brass* 4962 (BD, s).

4. **Podocarpus Steupii** Wasscher, n. sp. — *Podocarpus papuanus* (non Ridley) Steup, in Trop. Nat., 27 (1938) 145.

Rami plusminus incurvati, ramossimi, dense fasciculati. Folia oblique divergentia, rigidissima, valde falcata, subulata, acuta, pungentia, 2.5—3 mm longa, subquadriangula, facie inferiore acute, superiore minus acute carinata, decurrentia; folia ramulorum partium superiorum magis quinquefaria, lateraliter applanata, crassa, oblique divergentia, ad 5 mm longa, raro subpinnatim disposita; ramuli terminales novissimi breves, crassiores. Flores masculi ignoti. Flores feminei terminales in ramulis lateralibus brevibus folia brevia subulata, apicem versus in folia longiora plerumque adiacentia transientia ferentibus; receptaculum e 2 vel pluribus squamis carnosis compositum, squama sterili lamina libera obtusa, fertili carpidio erecto; ovulum unicum, raro 2. Ramuli fructiferi ad 16 mm longi, foliis sterilibus fructum involucrantibus divergentibus vel divaricatis, rectis vel nonnihil in-

curvatis, subquadriangulis, facie inferiore valde carinatis, plerumque sensim attenuatis in apicem acutum pungentem, 3—4 mm longis; receptaculum breve cylindraceum vel paulum obconicum, 2—3 mm longum 3 mm crassum, verrucosum; semen subglobosum, 5—6 mm diametro, apice anguste sed distincte elevato carpidii coronatum.

Twigs incurvate, strongly branched, compact. Leaves on the older twigs slightly spreading, triangular-subulate, dorsiventrally flattened, 2—3 mm long, decurrent with 1 mm broad base, strongly keeled; leaves of younger twigs strongly spreading, very rigid, strongly falcate, subulate, pungent, 2.5—3 mm long, nearly quadrangular on transverse section, slightly but sharply keeled above, strongly and sharply keeled beneath, concave on each side of the decurrent keel; leaves on the upper lateral twigs usually quinquefarious, laterally flattened, straight or slightly falcate, rigid, strongly spreading, rather abruptly attenuate into the mucronate apex, very strongly nerved, or sometimes indistinctly bifarious, in both cases up to 5 mm long. Young terminal shoots short, hardly overtopping the lateral twigs, rather stout. Male flowers unknown. Female flowers terminal on short lateral twigs with short, 2 mm long, slightly spreading, subulate leaves, which are usually adpressed, longer-subulate towards the apex; receptacle composed of 2 or more fleshy leaf-bases, the sterile one with short, obtuse, slightly laterally flattened, slightly falcate, free lamina, the fertile one with erect carpid, which overtops the ovule; ovules 1, rarely 2. Fruit-bearing twigs up to 16 mm long; sterile leaves below the fruit spreading or divaricate, straight or subfalcate, nearly quadrangular on transverse section, strongly keeled beneath, usually rather gradually narrowed into the mucronate, acute apex, 3—4 mm long; receptacle very short-cylindrical or somewhat obconical, 2—3 mm long and 3 mm in diam., warty; free lamina up to 3 mm long; seed subglobose, 5—6 mm in diam., somewhat keeled at the side of the carpid, with distinct, narrow, slightly prominent apex of the carpid. (Description from the type specimen.) Cfr. ***Fig. 2; Plate IV, 4.***

According to the herbarium label, the specimen mentioned below is a tree 12 m tall, with a bole 22 cm in diam. The lowermost branches are attached at 4.5 m above the base, whereas the incurved branchlets with leaf-bearing twigs are more or less bundled.

This species is probably most closely allied to *P. imbricata*, of which, however, it may be distinguished by the coarser, more subulate and spreading leaves and the different shape of the sterile leaves surrounding the receptacle. In general appearance it resembles *P. com-*

pacta most of all, but differs from it in the shorter, spreading, not dorsiventrally flattened leaves surrounding the receptacle, and the different shape of the other leaves.

CELEBES. Subdiv. Enrékang, Rantelemo, 3000 m el., *Boschproefstation* b.b. 22857, v.n.: tjimba-tjimba (B, f), type of the species.

5. **Podocarpus Cumingii** Parlatore, in D.C., Prodr., 16, II, 2 (1868) 521; Gordon, Pinetum, ed. 2 (1875) 356. — *Podocarpus cupressina* (non R. Brown) Vidal y Soler, Phan. Cuming. Phil. (1885) 160. — *Nageia Cumingii* Kuntze, Rev. Gen. Plant., 2 (1891) 800. — *Podocarpus imbricatus* var. *Cumingii* Pilger, in Engl., Pflanzenr., IV, 5 (1903) 56; Foxworthy, in Philipp. Journ. Sci., 2 (1907) Bot. 258; Perkins, Fragm. Fl. Philipp., 1 (1904) 44; Merrill, in Philipp. Journ. Sci., 5 (1910) Bot. 324; Pilger, in Bot. Jahrb., 54, 1 (1916) 36. — *Podocarpus imbricatus* Foxworthy, in Philipp. Journ. Sci., 6 (1911) Bot. 157 p.p. — *Podocarpus javanicus* Merrill, Enum. Philipp. Flow. Pl., 1 (1923) 3 p.p.

Twigs very compactly branched, erect or spreading. Leaves of the older twigs usually nearly adpressed, subulate, slightly dorsiventrally flattened, 3.5—6 mm long, keeled above, strongly keeled beneath, concave on each side of the keel, sometimes longer-subulate, straight and slightly spreading, 5—8 mm long and somewhat rhomboidal on transverse section; on the younger twigs similar, but somewhat shorter leaves, towards the apices sometimes quinquefarious, spreading, often more laterally flattened, subfalcate, 4—5 (rarely up to 8) mm long; on the uppermost lateral twigs the leaves often not entirely bifarious, slightly falcate, linear, usually up to 6 mm long by 1 mm broad, rarely up to 12 mm long by 1.25 mm broad. Young terminal shoots short, little overtopping the lateral twigs, with nearly adpressed or slightly spreading, subulate leaves. Male flowers terminal on short, 2—5 mm long lateral twigs with adpressed or slightly spreading, subulate, 2—2.5 mm long leaves; flowers cylindrical, 8—10 mm long by 2.5—3.5 mm in diam.; stamens with triangular, acute apiculus. Female flowers on short, lateral twigs with short, 2—2.5 mm long, somewhat spreading, falcate, subulate leaves, of which those involucrating the flowers are erect, narrow, subulate, abruptly narrowed into a thin mucro and nearly rhomboidal in transverse section with concave sides; receptacle composed of 2 (rarely more) fleshy leaf-bases, the sterile ones with slightly laterally flattened, obtuse lamina, the fertile ones with a carpid, which overtops the ovule; ovule 1, rarely 2. Fruit-bearing twigs straight, 6—18 mm long; sterile involucral leaves erect, enclosing the fruit, 7—13 mm long; receptacle subcylindrical or sub-

obconical, 2—3 mm long and 2 mm broad, warty; sterile lamina 3 mm long; seed globose, sometimes slightly narrowed towards the base, sometimes with distinct apiculus towards the apex, usually with slightly prominent rib on the back, 3.5—5.5 mm in diam., smooth, shining; apex of the carpid free, curved over the apex of the seed, up to 1.5 mm long. (Description from all the Philippine and Sumatra materials.) Cfr. *Fig. 2; Plate IV, 5.*

This species, based upon the specimen Cuming 803 by Parlatore, was degraded to a variety of *P. imbricata* by Pilger. It was simply included in this species by Warburg (Monsunia, 1, p. 191), as well as by Foxworthy. Also according to Perkins it differs so little from this species, that it might be better to unite the two. In my opinion, however, the difference is sufficiently large to distinguish it as a species. It differs from *P. imbricata, e.g.,* in its much less distinct leaf-dimorphism, the much longer, more subulate leaves, the absence of twigs with entirely adpressed, scale-like leaves, and the short young terminal shoots, but especially in the much longer, erect, falcate, sterile leaves involucrating the fruit and the always free apex of the carpid. According to Foxworthy, there occur many transitions between *P. Cumingii* and *P. imbricata.* It is probable, however, that he failed to note the differences in the involucral leaves and the apex of the carpid, since he only gives Pilger's description of *P. imbricata,* and does not mention the distinctive characters, mentioned by me; also Pilger does not describe the long sterile leaves below the receptacle in his var. *Cumingii.*

The plants from Sumatra deviate from those from the Philippines in the somewhat coarser foliage, whereas the free apex of the carpid is somewhat shorter and less prominent. A sterile specimen from Borneo should perhaps be included in this species; its twigs bear very rigid, subulate, 6—8 mm long leaves, passing into rigid, pinnately leaves towards the apex.

SUMATRA. Atjeh: Gajolanden, Poetjoek Angasan, 2600 m el., *Van Steenis* 8357 partly, v.n.: sangoe (B, f); Goh Lemboeh, 3000 m el., *Van Steenis* 9127, v.n.: sangoe (B, f); G. Kemiri, E. slope, 2900—3314 m el., *Van Steenis* 9649, v.n.: sangoe (B, m).

PHILIPPINES. Luzon: Benguet prov., Mt. Pulog, *For. Bur.* 18049 coll. *Curran, Merritt* and *Zschokke* (B, L, f); *Bur. Sci.* 40550 coll. *Ramos* and *Edaño* (B, S, m); prov. Tayabas and Laguna, Mt. Banajao, *Cuming* 803, type of the species (L, f); *Comisión de la Flora Forestal de Filipinas* 623bis (L, f); *Whitford* 951 (B, f); *Em. Weiss* 3820 partly (B, f); *Loher* 7137 (B, f); *Bur. Sci.* 2387 coll. *Foxworthy* (L, s); *Bur. Sci.* 27926 coll. *Ocampo* (B, s); prov. Tayabas, Lucban, *Elmer* 7465 (B, L, f); Panay: Antique prov., Mt. Midaas, *Yoder* s.n. (B, L, f); Mindanao: distr. Davao, Todoya, Mt. Apo, *Elmer* 11684 (B, L, U, f).

Perhaps also: BORNEO. W. Division: prob. near Sanggau, *Hallier* B. 775 (B, s).

6. **Podocarpus cincta** Pilger — *Podocarpus cinctus* Pilger, in Bot. Jahrb., 69 (1938) 253; Florin, in Kungl. Svensk. Vet. Akad. Handl., 19, 1 (1940) 23.

Fertile branchlets strongly branched into erect-spreading or spreading twigs, the older twigs with narrowly triangular-subulate, dorsiventrally flattened, strongly keeled, decurrent, up to 6 mm long leaves, the younger twigs densely leaved, the leaves somewhat spreading, straight or slightly incurved, finely subulate, pungent, decurrent with broad base, nearly rhomboidal on transverse section, strongly keeled beneath, concave on each side of the keel, 4—6 mm long. Terminal twigs rarely with incompletely bifarious, narrow, strongly curved leaves. Male flowers unknown. Female flowers terminal on short, straight, lateral twigs with spreading, slightly curved, subulate, 3—4 mm long leaves; sterile leaves surrounding the flower long, erect, falcately incurved and entirely involving the flower, narrow, rhomboidal on transverse section with concave sides; receptacle composed of 2 or more fleshy leaf-bases, of which one is fertile; the sterile one with slightly flattened, obtuse, free margin; carpid overtopping the ovule, strongly keeled on the back. Fruit-bearing twigs 0.5—2 cm long; sterile leaves surrounding the fruit erect, usually curved around the seed, 7—11 mm long; receptacle subcylindrical, 3—4 mm long and 2—3 mm in diam., warty; sterile lamina up to 2 mm long; seed subglobose, smooth, shining, 5—5.5 mm in diam.; apex of carpid slightly prominent, connate with the seed. (Description from all the materials examined.) Cfr. *Fig. 2; Plate IV, 6.*

This species which, according to Clemens, is one of the commonest and largest trees on Mt. Sarawaket, and has a bole 60 cm in diam., resembles *P. Cumingii* most of all, but differs in the more finely subulate, often somewhat more spreading leaves, the almost complete absence of the narrower bifarious leaves, and the apex of the carpid, which is not free.

In the specimen Clemens 5588, there occur, moreover, some detached branchlets with pinnately leaved twigs, which may have been collected from a seedling. The twigs bear very thin, subulate, 6—7 mm long leaves. The pinnately leaved twigs are large, sublanceolate, and 6—9 cm long by 2 cm broad.

NEW GUINEA. N.E. Part: Morobe-distr., Busu River, *Clemens* 5261, type of the species (BD, f); Mt. Sarawaket, Bog Meadow Camp, ca. 2650—3000 m el.,

Clemens 5562 (BD, f); *Clemens* 5588 (BD, f); Mt. Sarawaket, Busu River and vicinity, 2300—2650 m el., *Clemens* 6283 (BD, f).

7. **Podocarpus dacrydiifolia** Wasscher, n. sp.

Rami ramulis divaricatis, 2.5—5 mm diametro foliis inclusis. Folia fere adiacentia, subulata, basi lata decurrentia, apice incurvato breviter acuteque acuminata, nonnihil dorsiventraliter applanata, sectione transversa nonnihil triangularia, facie superiore subplana, inferiore obtuse carinata, 4—6.5 mm longa, circiter 0.5 mm lata. Flores masculi ignoti. Flores feminei in extremitatibus ramulorum brevium strictorum foliis 3—4 mm longis subulatis; folia sterilia flores involucrantia paulo longiora, nonnihil dorsiventraliter applanata, erecta vel nonnihil divergentia; receptaculum e 2 (vel raro pluribus) squamis carnosis compositum, quarum sterili lamina libera obtusa, fertili carpidio valde carinato; ovulum singulum, raro 2. Ramuli fructiferi 6—8 mm longi, foliis sterilibus fructum involucrantibus ad 10 mm longis seminis medium superantibus, adiacentibus; receptaculum subcylindricum, 3 mm longum, 2.5 mm crassum, verrucosum; semen subglobosum, 5.5 mm diametro, leve, lucens, apice extremitate carpidii nonnihil elevata coronatum.

Twigs with rather remote branchlets, bifariously alternate, 3—5 mm in diam. incl. the leaves, the youngest 2.5 mm in diam. Leaves of the older twigs rather strongly adpressed, somewhat spreading, slightly incurved, very narrowly triangular-subulate, rather thin, flat above, with a rounded keel beneath, 5—6 mm long by 0.75 mm broad; leaves on the younger twigs nearly adpressed, with incurved apex, subulate, decurrent with broad base, acuminate into a pungent tip, somewhat dorsiventrally flattened, slightly triangular in section, nearly flat above, rather strongly keeled beneath, concave at both sides of the keel, 4—6.5 mm long by 0.4—0.6 mm broad; leaves on the youngest shoots sometimes nearly entirely adpressed and very little triangular in section, but more flat and slightly rounded-keeled beneath. Male flowers unknown. Female flowers terminal on short, straight, erect-spreading lateral twigs, covered with 3—4 mm long, subulate, nearly adpressed leaves; sterile leaves below the flowers like the typical leaves as regards the shape, subulate, dorsiventrally flattened, nearly flat above, slightly rounded beneath, long, erect or slightly spreading, incurved around the flower; receptacle composed of 2 or more fleshy scales, the sterile one with falcate, obtuse, free lamina, the fertile one with strongly keeled carpid; ovule 1, rarely 2. Fruit-bearing twigs 6—8 mm long; sterile leaves below the fruit erect, adpressed, up to 10 mm long, reaching to over the middle of the seed; receptacle sub-

cylindrical, 3 mm long and 2.5 mm in diam. Seed subglobose, 5.5 mm in diam., smooth, shining, with the rib of the carpid on the back, and with slightly prominent apex of the carpid on the top. (Description from both collections mentioned below.) Cfr. *Fig. 2; Plate IV, 7.*

According to herbarium labels, *P. dacrydiifolia* is a tree up to 38 m tall, with very straight bole without buttresses and with a thin crown, which occupies about one-half of the total length. The wood is used for house-building. This species which, in sterile condition, agrees most of all *Podocarpus*-species with a *Dacrydium*, differs from *P. compacta* in the less compact ramification and in the thinner and longer subulate, nearly adpressed leaves.

CELEBES. Subdiv. Upper Binoeang, Oeloe Saloe (Pawreang Mts.), 1800 m el., *Boschproefstation* b.b. 13633, v.n.: sareh (B, L, f), type of the species; 2000 m el., *Boschpr.* b.b. 20872, v.n.: dokeh-dokeh (B, s).

8. **Podocarpus compacta** Wasscher, n. sp. — *Dacrydium* spec., Koorders, in Nova Guinea, VIII, 2 (1911) 615, p.p. — *Podocarpus papuanus* (non Ridley 1914) Pilger, in Bot. Jahrb., 68 (1936) 244; Van Steenis, in Colijn, Naar de eeuwige sneeuw (1939) 273.

Rami ramosissimi, ramulis dense fasciculatis, 2.5—5 mm diametro foliis inclusis. Folia divergentia, subulata, incurvata, nonnihil dorsiventraliter applanata, basi lata in ramulum decurrentia, apice in acumen acutum attenuata, 2.5—4 (raro ad 5) mm longa, 0.5—1.5 mm lata, facie inferiore valde carinata, facie superiore basin versus acutius carinata, apicem versus plana, raro foliis quinquefariis lateraliter applanatis transitum ad folia bifaria formantia. Flores masculi ignoti. Flores feminei in extremitatibus ramulorum brevium foliis subulatis; folia sterilia flores involucrantia erecta, incurvata, plerumque dorsiventraliter applanata, nonnunquam magis quadriangula, facie inferiore valde carinata, superiore plana vel acutius carinata; receptaculum e squamis 2 vel 3 carnosis compositum, quarum steriles lamina libera obtusa, fertiles carpidio valde carinato; ovulum singulum, raro 2. Ramuli fructiferi 8—18 mm longi; folia sterilia fructum involucrantia adiacentia vel vix divergentia, 4—10 mm longa, 0.5—1 mm lata; receptaculum subcylindricum, 4 mm longum, 3—4 mm crassum, verrucosum; semen subglobosum, nonnunquam latere carpidii nonnihil applanatum, 6—8 mm diametro, vix lucidum, nonnunquam bullis resinosis, apice extremitate carpidii nonnihil elevata coronatum.

Strongly and densely branched; twigs erect or upturned, 2.5—5 mm in diam incl. the leaves. Leaves spreading, subulate, curved upwards, slightly dorsiventrally flattened, narrowed into the acute

apex, decurrent on the twig with broad base, 2.5—4 (rarely up to 5) mm long by 0.5—1.5 mm broad, strongly keeled beneath, with concave sides, on the upper surface rather sharply keeled towards the base, flattened towards the apex; rarely with intermediary, quinquefarious leaves, which are slightly laterally flattened, somewhat spreading, rarely passing into small, bifarious leaves. Male flowers unknown. Female flowers terminal on short lateral twigs with somewhat smaller subulate leaves than the typical ones; sterile leaves below the flowers erect, strongly or slightly falcate, usually enveloping the whole flower. usually dorsiventrally flattened. sometimes somewhat more quadrangular on transverse section, strongly keeled beneath, with concave sides, flat or rather sharply angulate above; receptacle composed of 2—3 fleshy bracts, the sterile one with free, obtuse, subfalcate lamina, the fertile one with rather large, subelliptical, strongly keeled carpid. Fruit-bearing twigs 8—18 mm long; sterile leaves below the fruit adpressed, rarely slightly spreading, 4—10 mm long by 0.5—1 mm broad; receptacle subcylindrical, 4 mm long and 3—4 mm broad, warty; sterile lamina up to 3 mm long; seed subglobose, sometimes slightly flattened on the side of the carpid, or slightly truncate at the apex, 6—8 mm in diam., with thick rib on the back and with small, or rather strongly prominent apex of the carpid, smooth, sometimes with resinbladders, rather dull. (Description from all the flowering and fruit-bearing specimens mentioned below.) Cfr. ***Fig. 2; Plate IV, 8a, 8b.***

According to herbarium labels, the demensions of this species are rather variable. The specimens Lam 1773 and 2154, and Versteeg 2537, are all from shrubs nearly 4 m tall; Brass 4688, however, is from a tree up to 20 m tall, whereas it is remarked on the label of Brass 4284, that it is the largest tree of the high-mountain forest. The bole is irregular (Lam 1773), "below the branches mostly clear and fairly straight, the upper trunk often bent in serpentine manner, bearing heavy main limbs and stiff upturned minor branches" (Brass 4284). The bark is black, rough (Lam 1773), "thick, dark gray, shedding in stiff, irregular scales" (Brass 4284), or "brown, rough, scaly" (Brass 4688). The wood is hard, light brown (Lam 1773), or pale yellowish (Brass 4284). The crown is irregular, with crooked branches (Lam 1773), or "usually spreading, irregular, of thick crooked branches" (Brass 4688). The shape of the young trees is conical (Brass). The ovule is purple with bluish bloom, and the fruit is purple-brown (Lam 1773); ovules and fruits are glaucous green (Brass 4284 and 4688).

This species occurs in the high-mountain forests, at elevations up

to 4300 m, especially from 2500 m to 4000 m el. It differs from *P. papuana* in the long, adpressed, sterile leaves, which involucrate the fruit, and the longer, less thick leaves; from *P. dacrydiifolia* in the much compacter twigs with more spreading and shorter leaves, and from *P. Steupii*, besides in the different sterile leaves involucrating the receptacle, also in the somewhat broader, less rigid leaves. Moreover, this species has the largest seeds of all species of the section *Dacrycarpus*. The sterile leaves surrounding the fruit are always erect and usually entirely adpressed. For the rest there is a rather wide variation. In the specimen Brass 4284, the typical leaves gradually pass into the sterile leaves around the base of the flower, which are rather short and broad and strongly dorsiventrally flattened; this occurs also, but less distinctly, in the specimens Wissel 161 and Brass 4688. In the specimen Pulle 964, however, the typical leaves pass more abruptly into the involucral ones, which are much longer and narrower, and more quadrangular. The other fertile collections are more intermediate between these extremes.

The specimen Brass 4284a is said to have been taken from a seedling, and Brass 4347 and 4348 from young trees. All these plants already have the subulate leaves which also occur in the adult trees, but somewhat shorter and slightly convex above, by which the leaf shape shows some approach towards that of *P. papuana;* the leaves on the older twigs of these specimens are more flat-triangular and more adpressed, flat above, slightly keeled beneath, and 1.5—2 mm broad at the base. Pinnate twigs, however, as occur in seedlings and young sterile plants of *P. imbricata* and *P. papuana*, are absent in these plants.

Some of the plants, collected by von Römer, and all included in the genus *Dacrydium* by Koorders, also belong to *P. compacta*. Though there occur, besides the typical leaves, also leaves up to 6 mm long, the specimens von Römer 736 and 1237 entirely agree with other sterile collections of this species. Von Römer 1231 and 1238 bear, besides more typical ones, also leaves up to 7 mm long, subulate, straight or slightly falcate, very thin, and passing towards the apex into very narrow, 8—9 mm long, strongly falcate, nearly bifariously arranged leaves. In my opinion, it is not impossible that pinnate twigs are wanting in the genus *Dacrydium*. The most deviating plants, Von Römer 1215 and Pulle 965 (a plant 0.5 m tall, with the note: "perhaps youth form of Pulle 964"), have the main twigs covered with fine, narrow, subulate, spreading, usually subfalcate, 6—10 mm long leaves; these main twigs bear bifariously alternating lateral twigs with not exactly bifarious,

strongly falcate, very narrow, 6—10 mm long leaves. These leaves become but little shorter towards the apices and the bases of the twigs, which are 2—7 cm long and 8—16 mm broad, pinnate, and broadly linear in outline. The specimens Versteeg 2436 and Lam 2154 are more or less intermediate between the typical flower- and fruit-bearing plants and the preceding probably young plants. Lam 2154 has a tendency to form pinnate leafy twigs. Therefore it seems probable, that Pulle 965 is a seedling of *P. compacta*, and that, on the other hand, Brass 4284a is not taken from a seedling, but from a more adult tree. If this is not the case, a further distinction of species among the collections below would be necessary.

In the specimens Branderhorst s. n. and De Kock 43, which probably must be included in this species, the majority of the leaves is exactly 5-fariously arranged, spreading, laterally flattened, up to 4 mm long. Sometimes these leaves pass at the apex into nearly bifarious, up to 5 mm long ones.

NEW GUINEA. N.W. Part: Without further locality, *De Kock* 40 (B, f); Mt. Doorman, 3200 m el., *Lam* 2154 (B, s); 3260 m el., *Lam* 1773 (B, f); S.W. Part: without further locality, *Branderhorst* s. n. (B, f); *Branderhorst* 131 (B, f); Hellwig Mts, *Von Römer* 736 (B, L, s), 1215, 1231, 1237 and 1238 (all B, s); Hellwig Mts., 2600 m el., *Pulle* 965 (U, s); Wichmann Mts., 3100 m el., *Pulle* 964 (U, f); Hubrecht Mts., 3100 m el., *Versteeg* 2436 (U, s); Meervallei at Quarles Lake, 3600 m el., *Versteeg* 2537 (U, s); Mt. Carstensz, Grasbergen and rintis to Dajakweide, 3800 m el., *Wissel* 161 (B, f); 3800—4300 m el., *Wissel* 154 (B, s); Mt. Goliath, 3000 m el., *De Kock* 43 (B, s); S.E. Part: Central Division, Mt. Albert Edward, 3680 m el., *Brass* 4284, type of the species (B, BD, f); *Brass* 4284a (B, BD, s); *Brass* 4347 (BD, s); *Brass* 4348 (B BD, s); Wharton Range, Murray Pass, 2840 m el., *Brass* 4688 (B, BD, f).

9. **Podocarpus leptophylla** Wasscher, n. sp.

Ramuli tenuissimi, filiformes, stricti vel graciliter curvati, 0.25—0.4 mm diametro, foliis inclusis 1—2.5 mm diametro. Folia divaricata, paulum sub medio inflexa, tenuiter subulata, valde dorsiventraliter applanata, in apicem tenuissimum acuminata, basi carina dosali in ramulum decurrentia, facie superiore plana vel nonnihil concava, 1.25—2 mm longa, 0.3—0.4 mm lata. Flores et fructus ignoti.

Twigs very slender, filiformous, erect, straight, or elegantly incurved, flexible, the youngest ones 0.25—0.4 mm in diam., 1—2.5 mm in diam. incl. the leaves. Leaves on the older twigs adpressed, narrow-triangular, dorsiventrally flattened, very acute, slightly keeled beneath, 2—3 mm long by 0.6—0.7 mm broad; leaves on the younger twigs nearly horizontally spreading, abruptly or gradually inflexed just below the middle, thinly triangular-subulate, 1.25—2 mm long by 0.3—0.4 mm

broad, shining, strongly dorsiventrally flattened, acuminate into a very fine point, on the lower surface with strong, decurrent keel, sometimes nearly flat towards the apex, on the upper surface flat or slightly concave. Flowers and fruits unknown. (Description from both specimens mentioned below.) Cfr. *Fig. 2; Plate IV, 9.*

Since flowers and fruits are wanting, it cannot be stated with certainty whether these plants belong to *Podocarpus* or to *Dacrydium.* As regards the foliage, however, they mainly agree with certain *Podocarpus* species. At any rate the thin foliage is unique in either genus, and the species is certainly new to science.

NEW GUINEA. N.W. Part: without further locality, *Branderhorst* s. n. (B, s); Mt. Goliath, 3000 m el., *De Kock* 39 (B, s), type of the species.

2. Sect. **Nageia** Endlicher

§ *Dammaroideae* Bennett, in Horsfield, Pl. Jav. rar., 1 (1834) 41. — Sect. *Nageia* Endlicher, Syn. Conif. (1847) 207; Miquel, Fl. Ind. Bat., II, 6 (1859) 1071; Henkel & Hochstetter, Syn. Nadelhölzer (1865) 378; De Boer, Conif. Arch. Ind. (1866) 12; De Kirwan, Conif., 2 (1868) 225;

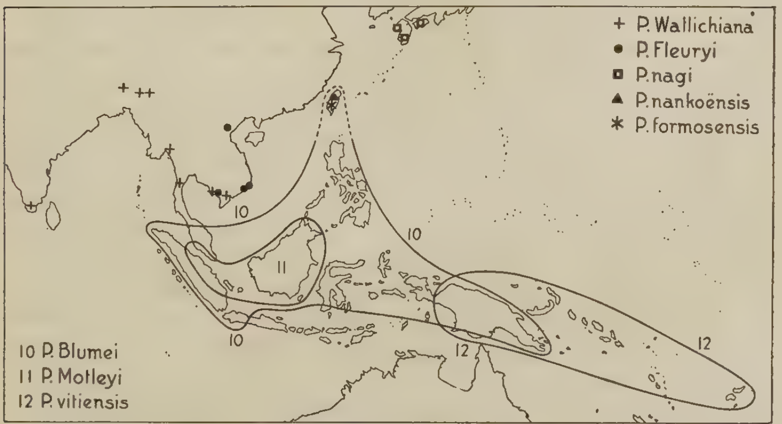

Fig. 3. Areas of the species of the section *Nageia,* and the only Malaysian species of the section *Polypodiopsis.*

Parlatore, in D. C., Prodr., 16, II, 2 (1868) 507; Miquel, in Siebold & Zuccarini, Fl. Jap., 2 (1870) 71; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1899) 104; Beissner, Nadelholzkunde (1891) 16; Pilger, in Engl., Pflanzenr., IV, 5 (1903) 59; in Engl. & Pr., Nat. Pflanzenfam.,

Nachtr. 3 (1908) 3; Foxworthy, in Philipp. Journ. Sci., 6 (1911) 157; Stiles, in Ann. Bot., 26 (1912) 448; Gibbs, in Ann. Bot. 26 (1912) 533; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 242, 245; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 272, 274. — Genus *Nageia* Gordon, Pinetum (1858) 134; ed. 2 (1875) 185; Carrière, Traité gén. Conif., II, ed. 2 (1867) 635.

Male flowers single, or to several fasciculate, on axillary peduncles. Female flowers single in the leaf axils; receptacle with 3—6 pairs of decussate scales, in maturity fleshy or dry; ovule single, much overtopping the carpid; seed globose, rather large, with bony testa. Trees with opposite ramifications; leaves opposite, large, ovate to oblong-lanceolate, with numerous, parallel nerves.

10. **Podocarpus Blumei** Endlicher — *Podocarpus latifolia* (non Thunberg 1794, nec Wallich 1830) Blume, Enum. pl. Javae, 1 (1827) 89; Hasskarl, in Tijdschr. Nat. Gesch. en Physiol., 9 (1842) 179; Cat. Plant. Hort. Bot. Bog. (1844) 70; Aanteek. Nut (1845) 72 (-us); Junghuhn, Java, 1 (1851) 507; Miquel, in Pl. Junghuhn., 1 (1851) 1 p.p.; Fl. Ind. Bat., II, 6 (1859) 1071 p.p.; idem, Suppl. Sumatra (1860) 252, 589 p.p.; Hasskarl, Neue Schlüssel (1866) 38; De Boer, Conif. Arch. Ind. (1866) 12, 28, 35, 37, 42, 50; de Kirwan, Conif., 2 (1868) 227 p.p.; Kurz, in Natuurk. Tijdschr. Ned. Ind., 27 (1874) 215; Filet, Plantk. Woordenb. (1876) 138; Hooker f., Fl. Brit. Ind., 5 (1888) 649 p.p.; Brandis, Ind. Trees (1906) 695, p.p.; Robinson, in Bull. Torr. Bot. Club, 35 (1908) 63. — *Podocarpus Blumei* Endlicher, Syn. Conif. (1847) 208; Dietrich, Syn. Plant., 5 (1852) 445; Henkel & Hochstetter, Syn. Nadelhölzer (1865) 380; Teysmann & Binnendijk, Cat. Plant. Hort. Bot. Bog. (1866) 14; Parlatore, in D.C., Prodr., 16, 2 (1868) 508; de Kirwan, Conif., 2 (1868) 227; Beccari, Malesia, 1 (1877) 178; Van Eeden, Houts. Ned. Ind. (1886) 135; ed. 3 (1906) 255; Engler, in Engl. und Pr., Nat. Pflanzenfam., II, 1 (1887) 104; Warburg, Monsunia, 1 (1900) 193; Pilger, in Engl., Pflanzenr., IV, 5 (1903) 60, ic. 9, B; Koorders & Valeton, Bijdr. Booms. Java, 10 (1904) 261; Merrill, in Philipp. Journ. Sci., 1, suppl. 1 (1906) 24; Foxworthy, in Philipp. Journ. Sci., 2 (1907) 258; De Clercq, Plantk. Woordenb. (1909) 309; Koorders-Schumacher, Syst. Verz., 1, fam. 5 (1910) 2; Koorders, Exkursionsfl. Java, 1 (1911) 67; Foxworthy, in Philipp. Journ. Sci., 6 (1911) 158, t. 28, fig. 2; Koorders & Valeton, Atlas Baumarten Java, 3 (1915) ic. 588; Pilger, in Bot. Jahrb., 54, 1 (1916) 36; 54, 3 (1916) 208; Beekman, in Meded. Proefst. Boschw., 5 (1920) 170, t. 56; Merrill, Enum. Philipp. Flow. Pl., 1 (1923) 2; Ridley, Fl. Mal. Pen., 5 (1925) 281; Pilger, in

Engl. und Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 245, ic. 134, B; Heyne, Nutt. Pl. Ned. Ind., ed. 2, 1 (1927) 108; Lam, Fragmenta Pap., 4 (1928) 103; in Nat. Tijdschr. Ned. Ind., 88 (1928) 217; Dakkus, in Bull. Jard. Bot. Buitenz., sér. 3, suppl. vol. 1 (1930) 236; Florin, Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 229, 272—274, text fig. 76, d, f, tab. X, 15, tab. XXI, 7; De Voogd, in Trop. Nat., 21 (1932) 219; Van Steenis, in Bull. Jard. Bot. Buitenz., sér. 3, 13, 1 (1933) 12, 30; Burkill, Dict. Econ. Prod. Mal. Pen., 2 (1935) 1779; Janssonius, Mikrographie, 13 (1936) 488; Pilger, in Bot. Jahrb., 68 (1936) 245; Wasscher, in Backer, Bekn. Fl. Java, 2 (1940) fam. 18, 2. — *Podocarpus agathifolia* Blume, Rumphia, 3 (1847) 217, t. 173; Walpers, Ann. Bot. Syst., 3 (1852) 449. — *Nageia Blumei* Gordon, Pinetum (1858) 135; ed. 2 (1875) 186; Carrière, Traité Conif. (1867) 640; F. von Mueller, Descr. not. Pap. pl., 1 (1875) 93; Kuntze, Rev. Gen. Plant., 2 (1891) 798. — *Podocarpus latifolia* f. *ternatensis* De Boer, Conif. Arch. Ind. (1866) 14. — *Podocarpus* spec., Koorders-Schumacher, Syst. Verz., 2 (1910) 12. — *Podocarpus Wallichianus* (non Presl, 1844) Ridley, in Journ. Str. Br. R. A. Soc., 60 (1911) 57.

Twigs usually opposite, rarely scattered or divaricate, spreading, terete, rather stout, often flattened towards the apex. Terminal buds small, narrowly ovate-conical, acute; bud scales adpressed, narrowly ovate-triangular, very acute-acuminate, up to 3 mm long. Leaves sub-opposite, the pairs 1.5—8 (usually 2.5—6) cm distant from each other, spreading or horizontally spreading, thick-coriaceous, usually rigid, oblong, oblong-lanceolate or ovate-lanceolate, sometimes more ovate-oblong, usually gradually, sometimes more cuneately narrowed or rounded into the short, slightly flattened petiole, usually rather shortly, sometimes longer acuminate, or more gradually narrowed into the sub-obtuse or acute apex, 7—23 (usually 8—12) cm long by 2—7 (usually 3—4) cm broad, 2—7.5 (usually 3—4.5) times as long as broad; in young plants the leaves usually narrower, oblong-lanceolate, and very long- and acute-acuminate, flexible; lamina striped, with flat margins, shining on both surfaces. Male flowers in fascicles or in short, spicate inflorescences with 1—7 (usually 3—6) flowers on common peduncles in the leaf axils; common peduncles usually opposite, slender, 1—7 (usually 2—5) cm long, with 2—5 pairs of decussate bracts or scars; flowers in the axils of ovate-triangular, usually acute, often caducous bracts, cylindrical, 5—11 mm long and 2—3 mm in diam.; anthers with short, broad, acute apiculus; pollen grains with 2 air bladders. Female flowers single in the leaf axils, usually opposite; peduncles slender;

receptacle short, with 5—7 spreading, obovate, 3 mm long and 1.5 mm broad scales; fertile scale long, narrowly obovate, excavated, obtuse, 5 mm long and 2—3 mm broad. Peduncles 5—32 (usually 10—20) mm long and 1.5—2 mm in diam., with 1—3 pairs of decussate bracts or scars; receptacle fleshy, subcylindrical, 7—18 (usually 10—14) mm long and 2—7 mm broad, with 5—7 scale-like bracts or scars of them, the upper one opposite to the carpid, the upper ones often more or less spine-shaped; the fertile scale with narrow free margin. Seed globose, up to 20 (usually 15—18) mm in diam., smooth. (Description from all the specimens mentioned below.) Cfr. *Fig. 3*.

According to herbarium labels, *P. Blumei* is a tree up to 40 m tall (up to 48 m according to Koorders and Valeton), and up to 119 cm in diam., with a straight trunk without buttresses, whereas the crown usually occupies ¼ to ½ of the total height. The smallest flowering or fruit-bearing tree was about 14 m tall. The bark yields some white resin or sap (Boschpr. b.b. 17348, b.b. 23823). The male flowers are bright yellow-green (Lörzing 7336), white (Boschpr. b.b. 2450), or dark-dirty yellow (Koorders 39592). The fruit is green (Koorders 39402, 39403, and 39415, Boschpr. b.b. 8842), dark green (Endert 4978), blackish (Boschpr. b.b. 18217), or black (Boschpr. Cel./III. 80), and has a bitter taste (Boschpr. b.b. 18217).

P. Blumei occurs in the old primary and secundary forests, from sea level up to 2100 m el.

In the sterile state it shows, like other species of the section *Nageia*, a great resemblance with the genus *Agathis*. It is, however, easy to distinguish by its acute terminal buds, which in *Agathis* are always globose and broader. Blume was the first to draw attention to this distinctive character (1847). When discussing the taxonomic status of *P. Motleyi*, Dümmer (Journ. Bot., 52, p. 240) pointed to this difference again. At the same occasion he indicated an anatomical difference between *Agathis* and *Podocarpus* Sect. *Nageia, viz.*, in *Podocarpus* the resin canals being situated below the nerves of the leaves, in *Agathis* between them.

The f. *ternatensis* is nothing but a form with very large leaves. Also from other parts of the Malay Peninsula such plants are known, *e. g.*, from Sumatra (Krukoff 238, Boschpr. E. 1357, Yates 2554), Bangka (Teysmann s. n.), Borneo (For. Dep. 4055), Java (Koorders 1268, Backer 8866) and Celebes (Boschpr. Cel./III. 146).

Some plants from the Malay Peninsula were first (1911) included by Ridley in *P. Wallichiana* Presl, later (1925) in *P. Blumei*. The latter

species differs from *P. Wallichiana* (occurring in East India, Burma, French Indo-China), according to Ridley (1925), in the more rigid-coriaceous, more ovate leaves with shorter point. Whereas Blume (1847) mentioned as a difference, *i. a.*, that *P. agathifolia* Bl. (= *P. Blumei*) is dioecious, and *P. Wallichiana* monoecious, Miquel (1851) believed, that Blume's species (*P. latifolia* and *P. agathifolia*) are not different from *P. latifolia* Wall. (= *P. Wallichiana* Presl). According to Pilger's descriptions (1903), *P. Wallichiana* has flexible, ovate or lanceolate-ovate leaves, gradually narrowed and caudate-acuminate towards the acute apex, and with rounded base, whereas the leaves of *P. Blumei* are thick and rigid, elliptical or elliptical-lanceolate, short-, rarely long-acuminate towards the subobtuse or rarely acute apex and gradually narrowed towards the base. I had not the opportunity to examine the plants from the Malay Peninsula. Of *P. Wallichiana* I examined the following specimens: Khasia, Hooker and Thomson s. n. (L, s); Assam, Kings' collector s. n. (L, m); and Tenasserim, Falconer s. n. (L, s). These plants, indeed, have thin-coriaceous and flexible leaves with a long and acute acuminate apex. But also among the specimens from the Malay Archipelago are some with similar, long-acuminate leaves. Especially the leaves of youth forms have such a shape, as, *e. g.*, Koorders 10287 from Sumatra (3—4 m tall), Hasskarl s. n. from Java (pl. jun.), Boschpr. E. 1143 from Java (young tree), and Brass 5880 from New Guinea (young tree 5—10 m tall); but also adult trees sometimes have long-acuminate leaves, *e. g.*, Boschpr. b.b. 15950 (from Bengkoeloe, 36 m tall), and Buurman van Vreeden 49 (from Palembang, 18—20 m tall). On the other hand, young plants do not always possess long-caudate-acuminate leaves, as, *e. g.*, is shown by the fact, that the specimens Van Steenis 3755 and De Voogd 449, both from the G. Pakiwang in South Sumatra, have such leaves too, whereas the specimens Van Steenis 3754 and De Voogd 451, also youth forms, 2 m high, and collected from the same locality, have more ovate, very broad, and shortly acuminate leaves. Therefore, it seems possible that, after further examination, *P. Wallichiana* Presl (1844) and *P. Blumei* Endl. (1847) may appear to be specifically identical.

MALAY PENINSULA. Sungei Kelantan, *Ridley* s. n. (S, s) (according to *Ridley* 1911, l. c., this is in Sumatra); Perak: Kintan, *Low*; Dindings: G. Tungul, *Ridley*; Negri Sembilan: G. Angsi; Johore: Mt. Austin; Bukit Soga; Singapore: Changi (all according to *Ridley* 1925, l. c.).

SUMATRA. Atjeh: subdiv. Tamiang, Tengalon, 400 m el., *Boschproefstation* b.b. 12212, v.n. kajoe tjina itam (B, s); Oostkust (E. coast): N.E. Sibajak, 1200 m el., *Lörzing* 7336 (B, L, m); Karo Plateau, on Mt. Siosar, 1575 m el.,

Lörzing 8628 (B, L, s); subdiv. Simeloengoen, forest reserve Bandar Betsy near Bandar Poelo, 50 m el., *Boschpr.* E. 1352, v.n.: siboeloesomak (B, L, s); Asahan, near Masihi, *Yates* 2554 (B, f); Hoeta Padang Estate, near Kisaran, *Krukoff* 238, v.n. bulusoma (B, S, s); Sigati, 20 m el., *Koorders* 10286 (B, s); 40 m el., *Koorders* 10287 (B, s); Tapiannoeli: subdiv. Sibolga, P. Moesala, 5 m el., *Boschpr.* E. 1357, v.n. laboe rimba (B, L, s); Djambi: Teloek Sialang, *Boschpr.* b.b. 11335, v.n.: kebal ajam (B, s); Bengkoeloe: subdiv. Redjang, Tjoeroep, 800 m el., *Boschpr.* E. 1084, v.n.: medang sepaling abang (B, L, s); subdiv. Redjang, near Talang Remba Air Tidatar, *Boschpr.* b.b. 2450, v.n.: medang sepaling (B, L, m); Kepahiang, 650 m el., *Boschpr.* b.b. 15950, v.n.: kajoe lanang (B, s); Karanganjar, 900 m el., *Boschpr.* b.b. 8842, v.n.: medang sepaling (B, L, s); Palembang: forest Panero Kan, *Buurman van Vreeden* 49, v.n.: sitebel (B, s); subdiv. Banjoeasin, Bajoenglintjir, 15 m el., *Boschpr.* E. 1106, v.n. setebal (B, L, s); subdiv. Pasemahlanden, marga Lb. Boentaboenta, Pg. Seleman, 1200 m el., *Boschpr.* T. B. 200, v.n.: kajoe lanang (B, L, s); Ranau Lake, G. Pakiwang, 700 m el., *Van Steenis* 3754 (B, L, s); *Van Steenis* 3755 (B, s); *De Voogd* 451 (B, s); 900 m el., *De Voogd* 449 (B, s); Lampongsche Districten, div. Semangka, Koeta-Agoeng, 650 m el., *Gusdorf* 312, v.n.: kajoe lanang abang (B, s).

BANGKA. Near Djeboes, *Teysmann* 3278 H. B., v.n.: kajoe mangkeboel (B, s); *Teysmann* 3505 H. B. (U, s); Soengailiat, *Teysmann* s. n., v.n.: mangkeboel (B, L, G, s); *Berkhout* 430, v.n.: memboeloe (B, s); Soengailiat, Mt. Boei, *Teysmann* s. n. (B, G, s); subdiv. Toboali, 300 m el., *Bünnemeijer* 2341 (B, f); subdiv. Zuid-Bangka, Perlang, 5 m el., *Boschpr.* b.b. 10889, v.n.: mentebal (B, s); Rindik, 40 m el., *Boschpr.* b.b. 11307, v.n.: boeloh (B, s).

KARIMATA ARCHIPELAGO. Soengei Tajan, *Teysmann* s. n., v.n.: radja kajoe (B, L, s).

BORNEO. British North Borneo: without further locality, *Wood* 1244 (B, s); Gompa, Kudat, sea level, *For. Dep.* Br. N. Borneo 4055 coll. *Balajadia* (S, s); Mt. Kinabalu, 2200 m el., on Spur E. of Dehobang River, *Clemens* s. n. (B, s); Western Part: Soeka Lanting, *Hallier* B. 231 (B, s); Eastern Part: subdiv. Tidoengsche Landen, Noenoehan, 4 m el., *Boschpr.* b.b. 18217, v.n. kajoe pagi, or demelai (B, f); subdiv. Boeloengan, near Kabirau, S. Simendoeroet, 1000 m el., *Boschpr.* b.b. 11739, v.n.: totokan (B, s); Soengei G. Long Djean, 250 m el., *Boschpr.* b.b. 22647, v.n.: lemhan (B, s); subdiv. West-Koetai, near Poekoes, 100 m el., *Endert* 4978 (B, f); Mahakam, *Amdjah* 51 (B, L, s); Southern Part: subdiv. P. Tjahoe, Boboeat, 150 m el., *Boschpr.* b.b. 10964, v.n.: tarong (B, s).

JAVA. Without further locality, *Blume* s. n. (L, f, s) perhaps originals of *P. latifolia Blume*; *Hasskarl* s. n., pl. junior. (L, s); *Hasskarl* s. n. (L, m); *Junghuhn* s. n. (B, L, s); *Miquel* s. n. (L, m); *Zollinger* 3025 (U, f); West-Java: G. Lajoeng, Tjimara Oedjongkoelon, 150—250 m el., *Koorders* forest no. 51*, herb. no. 1261, v.n.: djerret (B, L, s); G. Tiloe, 200—500 m el., *Koorders* forest no. 50*, herb. no. 1268 (B, s); Pandeglang, Oedjongkoelon, near Moeara Tjiboenar, 150 m el., *Boschpr.* E. 1143 (B, s); G. Salak, coll. ?, v.n. kibima (L, s); *Kollmann* s. n. (ex *Pilger*, 1903, l. c.); 1000 m el., *Koorders* 24181, v.n.: kidamar (B, L, s); *Koorders* 33207 (B, s); Parakansalak, *Koorders* 39404 (B, L, s); 1000 m el., *Koorders* 39403, v.n.: kibima (B, f); forest no. 2501a, herb. no. 39402, v.n.: kibima (B, f); forest no. 2502a, herb. no. 39415, v.n.: kibima (B, f); forest no. 2503a, herb. no. 39409, v.n.: kibima (B, L, s); forest no. 2504a, herb. no. 39413 (B, f); 1100 m el.,

Koorders 39406, v.n.: kibima (B, f); 1350 m el., *Koorders* 39407, v.n.: kibima (B, m); G. Megamendong, *Junghuhn* s.n., v.n.: kibima (L, U, s); G. Pangrango, 1000 m el., *Junghuhn* s. n., v.n.: kibima (L, f); *"Houtsoorten van den Gedeh* no. 204", v.n.: kipoetri (L, s); G. Gedé, near Djaringan, 500—1000 m el., *Backer* 10438 (B, s); Pasir Datar, *Jesuiet* field no. 289, herb. no. 1307 (W, s); G. Sanggaboewana, N. of Tjiandjoer, 1200 m el., *Backer* 23930 (B, s); Takokak (Djampangwetan), *Koorders* 1264 (B, L, s); *Koorders* 1265, 1266, 1267, v.n.: kimalela (B, s); *Koorders* forest no. 2135a, herb. no. 1262 (B, L, s), 1263 (B, s); 11909 (B, L, s), 25599 (B, s), 32768 (B, s), and 39596 (B, L, f); 1200 m el., *Koorders* forest 2446a, herb. no. 39592 (B, m); Bivouac Denoe on Tjipatoedja, 450 m el., *Backer* 8866 (B, L, s); East-Java: Blitar ?, without coll., v.n.: dewan doro (B, s).

PHILIPPINES. Luzon: Cagayan prov., *For. Bur.* 16738 coll. *Curran* (B, s); Isabela prov., *Bur. Sci.* 47333 coll. *Ramos & Edaño* (B, S, f); Apayao subprov., *Bur. Sci.* 28348 coll. *Fenix* (B, f); Bataan prov., *For. Bur.* 1716 coll. *Curran* (B, L, f); Bataan prov., Lamao River, *For. Bur.* 194 coll. *Barnes* (B, f); Sibuyan, Magallanes (Mt. Giting-Giting), *Elmer* 12360 (B, L, U, f).

CELEBES. Subdiv. Gorontalo, 400 m el., *Boschpr.* b.b. 15602, v.n.: molosambonge or tombolilato (B, L, s); subdiv. Malili, Oesoe, 5 m el., *Boschpr.* Cel./III. 80, v.n.: tanragoeli (B, f); *Boschpr.* Cel./III. 143, v.n.: tanranggoeli (B, s); 50 m el., *Boschpr.* Cel./III. 144 and 145 (B, s); 25 m el., *Boschpr.* Cel./III. 146 (B, s); subdiv. Malili, Lampea, 20 m el., *Boschpr.* b.b. 23257, v.n.: kajoe tjina (B, s); subdiv. Malili, Tambarano, 600 m el., *Boschpr.* b.b. 9696, v.n. tandanggoeli (B, L, s); Lepo-lepo, near Kendari (ex Beccari l. c.).

MOLUCCAS. Ternate: *Teysmann* s. n. (B, L, U, G, f, originals of f. *ternatensis De Boer*); *Teysmann* 5189 H. B. (B, s); Batjan: without coll. (B, s); Laoe Indari, 200 m el., *Boschpr.* b.b. 17348, v.n.: salononaoe or damar laki-laki (B, s); Masoeroeng, 500 m el., *Boschpr.* b.b. 23127 and 23136, v.n.: damar radja laki-laki (B, f); Obi: Sesepe, *Atasrip* 118, v.n.: damar radja (B, L, s); Hol Hoeroe (Manomang) Anggai, 600 m el., *Boschpr.* b.b. 23823, v.n.: damar radja laki laki (B, s); Ceram: Loki, Asaoedi, 700 m el., *Boschpr.* b.b. 17555, v.n.: damar laki-laki (B, s); Seapoetih (Hoalmoal), 400 m el., *Boschpr.* b.b. 19647, v.n.: damar laki (B, s).

NEW GUINEA. N.W. Part: Ramoi and Andai (ex *Beccari* l. c.); Mamberamo River, Idenburg River, near Prauwenbivak, 120 m el., *Lam* 2161 (B, s); N.E. Part: Goromia, 300 m el., *Schlechter* 17395 (BD, s); Etappenberg, 850 m el., *Ledermann* 9027 (BD, m); Morobe distr., Quembang mission, 800 m el., *Clemens* 1231 (BD, s); 650 m el., *Clemens* 2172 (BD, f); Yoangen, 1300 m el., *Clemens* 6607 (BD, s); S.E. Part: Western Division, Wuroi, Oriomo River, 5—10 m el., *Brass* 5878 (B, BD, f), *Brass* 5880 (B, BD, s), *Brass* 5906 (B, m); Central Division, Dieni, Ononge road, 500 m el., *Brass* 3962 (B, s); Sogeri region, *Forbes* 911 (L, s).

Cultivated: in the Bot. Garden, Buitenzorg, V. F. 13 from S. New Guinea (B, s); V. F. 82 and 82a (B, G, s), 98 and 98a (B, s), all from Java; V. F. 91 and 91a from Bangka ? (B, f); V. F. 9 (B, s), of unknown provenance.

Further distribution: Probably Formosa (ex Forbes & Hemsley, in Journ. Linn. Soc. 26, p. 547, sub nom. *P. latifolia Wallich*).

11. **Podocarpus Motleyi** (Parlatore) Dümmer — *Dammara Motleyi* Parlatore, Enum. Sem. Hort. Bot. Florent. (1862) 26; in Seemann, Journ. Bot., 1 (1863) 36; in D.C., Prodr., XVI, II, 2 (1868) 377. —

Podocarpus Beccarii Parlatore, in D.C., Prodr., XVI, II, 2 (1868) 508; Warburg, Monsunia, 1 (1900) 193; Pilger, in Engl., Pflanzenr. IV, 5 (1903) 59; Merrill, Bibl. enum. Born. pl. (1921) 31; Heyne, Nutt. pl. Ned. Ind., ed. 2 (1927) I, 108; Polak, in Verh. Kon. Akad. Wet. Amsterdam, XXX, 3 (1933) 20, 32; Van Steenis, in Bull. Jard. Bot. Buitenz., sér. 3, XIII, 1 (1933) 27; Slyper, in Rec. Trav. bot. néerl., 30 (1933) 502, ic. 14. — *Nageia Beccarii* Gordon, Pinetum, ed. 2 (1875) 186; Kuntze, Rev. Gen. Plant., 2 (1891) 798. — *Agathis Motleyi* Warburg, Monsunia, 1 (1900) 185; Merrill, Bibl. enum. Born. pl. (1921) 32. — *Podocarpus* spec., Seward and Ford, in Phil. Trans., 198 (1906) 317. — *Podocarpus Motleyi* Dümmer, in Journ. Bot., 52 (1914) 240; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 245; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 272, 274.

Twigs opposite, rarely scattered, terete, with thickened base, more angulate towards the apex. Terminal buds usually rather large, ovate-acute; bud scales ovate-acute, sometimes long-acuminate, often slightly spreading, to 5 mm long. Leaves subopposite, crowded towards the apices of the twigs, the pairs 6—22 mm distant from each other, thick-coriaceous, very rigid, elliptical, sometimes elliptical-oblong, cuneately narrowed into the very short, thick, slightly flattened petiole, rather shortly narrowed into the rounded, obtuse, sometimes somewhat acute or short-acuminate apex, usually 3—5 cm, rarely to 7.5 cm long by 13—28 mm broad, 1.5—3 times as long as broad; lamina with flat margins, shining on both surfaces. Male flowers single in the leaf axils, sessile, thick-cylindrical, 7—19 mm long and 5—7 mm in diam.; stamens with large, triangular, acute or acuminate apiculus, with membranous margin, slightly keeled; pollen grains with 2 air bladders. Female flowers single in the leaf axils, with short peduncles; receptacle with nearly 7 large, obovate or ovate bracts, with obtuse or slightly acute apex and membranous margin, 3—4 mm long by 2—2.5 mm broad; the fertile bract oblong-obovate, obtuse, excavated, 4 mm long by 2—2.5 mm broad. Peduncles short, to 5 mm long and 1.5—2 mm in diam., with 3—4 pairs of decussate scars; receptacle fleshy, subcylindrical, 8—12 mm long and 3—6 mm broad, with 5—9 free scales or scars of these, the upper ones often more or less spine-shaped; carpid with 1 mm broad, free margin. Seed globose, up to 20 (usually 13—15) mm in diam. (Description from the specimens mentioned below.) Cfr. *Fig. 3; Plate IV, 11a—d.*

According to herbarium labels, *P. Motleyi* is a tree up to 40 m tall, with a straight, terete bole up to 90 cm in diam., and without

buttresses; the crown occupies about one-third of the total length. The bark yields little white resin (Boschpr. b.b. 6368). The fruit is whitish green (Grashoff 1138), or dark green with glaucous bloom (Boschpr. 12T. 1P. 13). In the collection Boschpr. 12T. 1P. 185 a very great part of the receptacles are cleaved longitudinally.

This species occurs in young and old, primary and secondary forests of the lower, flat, often swampy regions, usually little above sea-level. It differs from *P. Blumei* in its solitary, sessile male flowers, the shorter fruit-bearing peduncles, the larger terminal buds and the smaller, more crowded leaves.

MALAY PENINSULA. Dindings: Legari Melintang, *For. Dep.* 16568 coll. *Strugnell,* v.n.: raja kayu (S, f); Johore: S. Kayu, Mawai-Temulang Road, at low el., *Sing.* Field no. 21341 coll. *Corner* (B, S, f).

RIAU ARCHIPELAGO. P. Karimoen, Teloek Lekoep, 1.5 m el., *Boschpr.* b.b. 17229, v.n.: kebal ajam (B, s).

SUMATRA. Oostkust (E. coast): Bengkalis, Batoe Pandjang, 1 m el., *Boschpr.* b.b. 14063 (B, s); Palembang: Banjoeasin- and Koeboestreken, near Banjoenglintjir, 15 m el., *Boschpr.* 12T. 1P. 13, v.n.: kajoe setebal (B, L, f, m); *Boschpr.* 12T. 1P. 185 (B, L, W, f); 20 m el., *Grashoff* 874, v.n.: setobal (B, L, m); Rawas, 150 m el., *Grashoff* 1138, v.n.: kajoe bawah (B, L, f).

BORNEO. Sarawak: *Beccari* P. B. 2649, originals of *P. Beccarii Parl.* (B, f); Western Part: subdiv. Pontianak, Koeboepadi, 5 m el.; *Boschpr.* b.b. 6368, v.n.: kajoe tjina, manoek koeboel (B, s); subdiv. Simpang, Loeboekbatoe, 5 m el., *Boschpr.* b.b. 7364, v.n.: kajoe tjina (B, s); Eastern Part: subdiv. Tidoengsche landen, S. Lebakis, 5 m el., *Boschpr.* b.b. 18328, v.n.: kajoe pagi, kajoe seriboe (B, S, s); Southern Part: subdiv. Poeroek Tjahoe, Tahoedjan, 500 m el., *Boschpr.* b.b. 21151, v.n.: kajoe seriboe (B, f); Bandjermasin, *Motley* (ex *Parlatore* l. c.); subdiv. Sampit, S. Poetjoek, 12 m el., *Boschpr.* b.b. 11613, v.n.: marimboe (B, s).

3. Section **Polypodiopsis** Bertrand

in Ann. Sci. Nat., 5me sér., 20 (1874) 65; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 275, 278; 19, 2 (1940) 8, 25, 71, ic. 2.

Male flowers usually in the axils of decussate bracts on leafless twigs, or rarely in the leaf axils, and moreover terminal on the pinnate twigs. Female flowers in the axils of bracts; receptacle with nearly 5 pairs of decussate, sterile scales; ovule 1, rarely 2, much overtopping the carpid; seed obovate, the testa without woody layer. Trees with decussate ramifications, the uppermost twigs with decussate bracts, the other ones with the leaves decussate but turned in one plane, apparently bifarious, pinnately arranged, small, with a single rib; stomata on both surfaces.

The systematic place of *P. vitiensis* has changed many times.

Seemann first thought that it was a new genus allied to *Podocarpus*. He based his opinion upon the entirely different appearance and the different shape of the seed. Whereas the seed in *Podocarpus* is always subglobose, it is, in *P. vitiensis*, ovate-acuminate and not oblique, but equilateral. By the incomplete fruit materials and the absence of flowers, however, he was obliged to include the species in *Podocarpus*. And, as the leaves bear stomata on both surfaces and have a single rib, he included it in the section *Dacrycarpus*.

Bertrand based, on account of anatomical differences, the new section *Polypodiopsis* upon *P. vitiensis*. Not only is there a resin canal below each vascular bundle, but also one at each side of the midrib near the leaf margins. Moreover, the course of the vascular bundles in the stem is entirely different from those of other *Podocarpus* species. In the species he included also the doubtful *Polypodiopsis Muelleri* Carrière (which, according to J. H. in Kew Bulletin, 1920, p. 372, is *Bauprea Balansae* Brogn. et Gris., a *Proteacea* from New Caledonia), and the equally doubtful *Torreya bogotensis* Linden.

Pilger (1903) provisionally added *P. vitiensis* to the section *Nageia* on account of the opposite leaves, which are broad at the base, though it is different by its narrower leaves and the characters of the male flowers. The female flowers were unknown to him.

Gibbs (1909) first included the species in the section *Stachycarpus* on account of the position of the female and male flowers, and considered it most closely allied to the New Zealand *P. ferruginea* Don. Later (1912) she followed Pilger, in spite of the single rib of the leaves. The stone-cells, which, according to Pilger, only occur in the seed wall of species of the section *Stachycarpus*, are absent in the seeds of *P. vitiensis*; moreover, the peduncle of *P. nagi* shows some resemblance with that of *P. vitiensis*, whereas the ramification of the peduncle, "so accentuated in the Fijian plant, is also to a certain degree represented in section *Nageia*". Besides she writes: "It is therefore thought advisable to follow Pilger, and leave *P. vitiensis* provisionally in sectio *Nageia*, though the very characteristic branching of the peduncle, the four vascular bundles of the ovuligerous scale" (= ephimatium) "and the semi-orbicular ridge, which terminates it, together with the beak-like prolongation of the nucellus into the micropyle, are features which seem to distinguish it from all the other sections".

Florin (1931) re-established the section *Polypodiopsis*. As the most important characters of this section he mentions the single-ribbed leaves, the resin canals, the decussate insertion of the leaves, the alternatingly

left and right torsion of the leaf-cushions, and the constantly right [1]) turn of the leaf bases on plagiotrope shoots of the latest order. Also in the structure of the epidermis this section is very homogeneous. Besides *P. vitiensis*, he also included *P. minor* from New Caledonia, and *P. Rospigliosii* from Peru in it.

I agree with Florin, that this section must be re-established; the section Nageia thus becomes much more homogeneous. If, however, the name *Polypodiopsis* may be valid according to nomenclature rules, is questionable, as the name has evidently been taken from *Polypodiopsis Muelleri,* which is no *Podocarpus,* but a Proteaceous plant.

12. Podocarpus vitiensis Seemann, in Bonplandia, 10 (1862) 365; in Journ. Bot., 1 (1863) 33, t. II; Fl. Vitiensis (1865—73) 266, t. 78; Pilger, in Engl., Pflanzenreich, IV, 5 (1903) 63; Gibbs, in Journ. Linn. Soc., 39 (1909) 182; in Ann. Bot., 26 (1912) 533, t. 49, ic. 14—16, t. 50, ic. 17, 18, t. 53, ic. 72, 73; Stiles, in Ann. Bot., 26 (1912) 455; Pilger, in Bot. Jahrb. 54, 1 (1916) 36; in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 245; Dakkus, in Bull. Jard. Bot. Buitenz., sér. 3, suppl. vol. 1 (1930) 237; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 192, 229, 274—276, 278, ic. 77, d, e; 19, 2 (1940) 11, 25. — *Nageia vitiensis* Kuntze, Rev. Gen. Plant., 2 (1891) 800.

Branchlets terete, smooth, striped by decurrent lines. Twigs decussate, in pairs at distances of 2.5—4 cm, spreading or erect-spreading, dimorphic (nearly as in *Taxodium*): main twigs terete, or slightly flattened below the ramifications, leafless, alternatingly bearing decussate lateral leafy twigs, and decussate, ovate to orbicular, nearly 2 mm long, deciduous bracts, terminated by a bud; the lateral twigs slender, usually unbranched, rarely branched, with the leaves decussate but turned in one plane, with pinnate appearence, up to 38 (usually 8—15) cm long, terminated by a small bud, which probably never develops. Terminal buds of the main twigs globose or ovate, small, with decussate, ovate, orbicular or obovate, obtuse, 1.5—2 mm long scales; scales of the terminal buds of the leafy twigs somewhat smaller. Leaves decussate, but turned in one plane and pinnately arranged, the pairs at distances of 3—6 mm, of each pair the one leaf with the upper surface, the other with the lower surface directed upwards; all leaves strongly spreading, nearly lanceolate, rather acute towards the obtuse apex, broadly rounded at the base, sessile, decurrent down to the axils of the following pair of leaves, 1.5—3 cm long by 3—5 mm broad,

[1]) see foot-note p. 364.

those in the basal part of the twigs shorter and more oblong; midrib on the morphological upper surface usually broad and flat- or rounded-prominent, on the morphological lower surface slightly and narrowly prominent, flat, or slightly and broadly impressed; lamina slightly shining, with flat or somewhat incurved margins. Male flowers sessile, rarely in the axils of the lowermost leaves, usually on short lateral twigs in the basal portion of the leafy twigs, or on short lateral twigs in the upper portion of the main twigs, these bearing decussate, deciduous, ovate, obtuse bracts, in the axil of which is either a flower or a small twig with a terminal flower and a few decussate flowers; flowers cylindrical, 12—20 mm long and 2—2.5 mm in diam.; stamens with triangular-ovate, obtuse apiculus; pollen grains with 2 air bladders. Female flowers in the axils of bracts, on peduncles 2—8 mm long, sometimes branched, with a few decussate, acute bracts; receptacle with nearly 5 pairs of broadly ovate, sterile, decussate, 2 mm long bracts, and one slightly longer carpid; young seed obovate, narrowed towards the base; seed (after Seemann ex Pilger) obovate, obtuse. (Description from the specimens mentioned below, and a female plant from the Fiji Islands [Gillespie 3712]). Cfr. *Fig. 3.*

According to herbarium labels this species is a tree up to 33 m tall. According to Gibbs l. c., it is "a beautiful tree with splendid shaft clothed in smooth white bark and a crown of spreading branches. The wood is the most valuable timber of the Fiji Islands, being not over hard and very durable". Sometimes there are 2 fertile scales. The young fruit is said to be beautifully magenta-red, with a waxy bloom.

All the parts of this plant, with the exception of the stamens, are decussately arranged. Furthermore the twig dimorphism is very remarkable. In the herbarium specimens the main twigs bear decussate bracts in the uppermost part, and below these bracts 1—3 pairs of usually leafy, rarely leafless twigs.

According to Seemann (1865), Pilger (1903), and Florin (1940, p. 11), the male flowers are terminal on the leafy twigs. The axis of these twigs is continued into a short peduncle, which bears few sterile, decussate brates. Rarely a lateral male flower should be found in the axil of one of these bracts. From the Peruvian species *P. Rospigliosii*, however, Florin describes the male flowers arranged in short lateral inflorescences borne by ordinary leafy twigs, as described by me in *P. vitiensis*. *P. minor* has as well lateral inflorescences as terminal flowers; moreover, flowers rarely occur in the axils of the leaves. The latter is also described by me from *P. vitiensis*. It is possible, that the

terminal buds of the leafy twigs, as described by me, also are male flower buds. At any rate, the male flowers of the three closely allied species are hardly different from each other.

NEW GUINEA. S.E. Part: Alola, 1650—2000 m el., *Carr* 14160 (L, m); Lala River, 1650 m el., *Carr* 15666 (L, m).

BISMARCK ARCHIPELAGO. New Ireland (Neu Mecklenburg), near Namatanai, 900—1100 m el., *Peekel* 586 (ex *Florin* 1931 l. c.).

Cultivated: in Hort. Tjibodas, R. 8, from New Guinea (B, m).

Further distribution: Fiji Islands.

4. Section **Eupodocarpus** Endlicher

Sect. I, Bennett, in Horsfield, Pl. Jav. rar., 1 (1838) 39. — Sect. *Eupodocarpus* Endlicher, Syn. Conif. (1847) 208; Miquel, Fl. Ind. Bat., II, 6 (1859) 1072; Henkel & Hochstetter, Syn. Nadelhölzer (1865) 381; De Boer, Conif. Arch. Ind. (1866) 14; Carrière, Traité Conif., II, ed. 2 (1867) 644; Parlatore, in D.C., Prodr., 16 (1868) 509; de Kirwan, Conif., 2 (1868) 224; Miquel, in Siebold et Zuccarini, Fl. Jap., 2 (1870) 69; Gordon, Pinetum, ed. 2 (1875) 326; Eichler, in Engl. & Pr., Nat. Pflanzenfam. II, 1 (1889) 104; Beissner, Nadelholzkunde (1891) 16; Pilger, in Engl., Pflanzenr., IV, 5 (1903) 73; in Engl. & Pr., Nat. Pflanzenfam., Nachtr. 3 (1908) 3; Foxworthy, in Philipp. Journ. Sci., 6 (1911) 160; Stiles, in Ann. Bot., 26 (1912) 448; Gibbs, in Ann. Bot., 26 (1912) 543; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 242, 247; Hickel, in Lecomte, Fl. Gén. Indo-Chine, V, 10 (1931) 1066; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 279, 283.

Male flowers single or in bundles of 2—8 in the leaf axils, sessile or on very short common peduncles, cylindrical or nearly filiformous; stamens with distinct apiculus, rarely absent. Female flowers single, axillary, on short or slender peduncles; receptacle always distinctly developed, usually composed of 2, sometimes of 3 or 4 fleshy scales, which are decussate with 2 subulate, deciduous, sterile bracts at the base ("foliola") [1]; ovules single, rarely 2, much longer than the short, free margin of the fertile scale; seed rather large, globose-elliptical or elliptical, with coriaceous testa. — Trees or shrubs, with scattered oblong to linear leaves with a single rib; stomata on the lower surface.

13. Podocarpus deflexa Ridley — *Podocarpus neriifolia* (non D. Don 1824) Ridley, in Journ. Fed. Mal. St. Mus., VI, 3 (1915) 198. — *Podocarpus deflexus* Ridley, Fl. Mal. Penins., 5 (1925) 283; Florin, in

[1]) sometimes absent in species not occurring in the area dealt with.

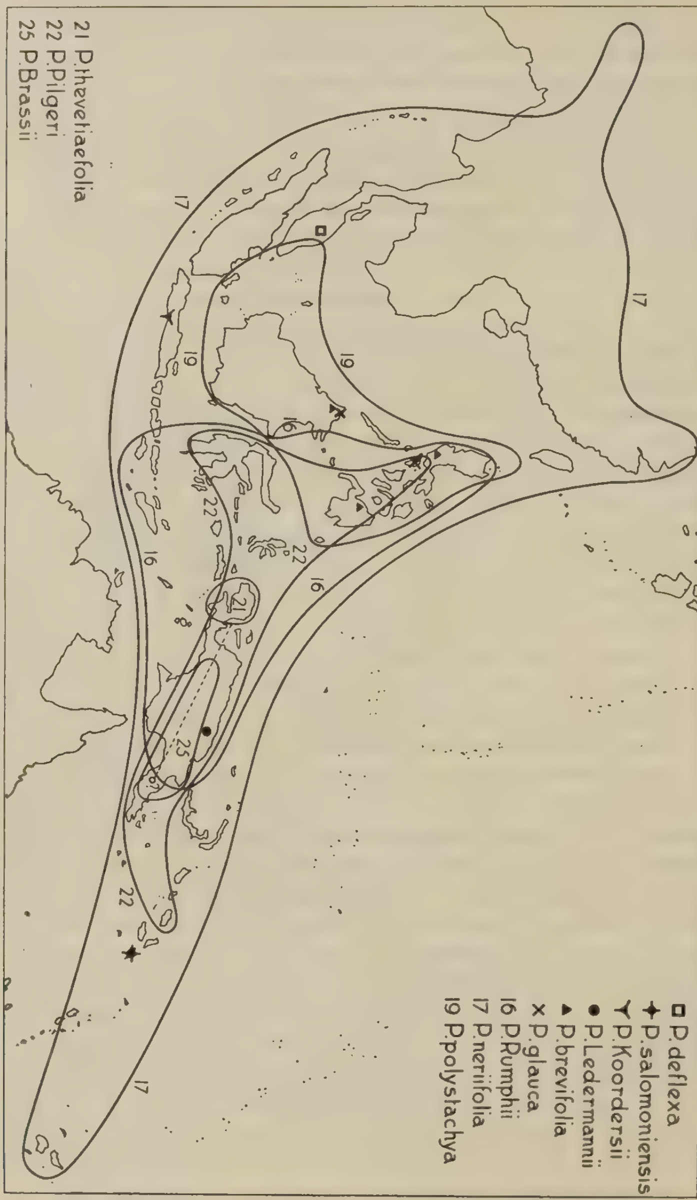

Fig. 4. Areas of the Malaysian species of the section *Eupodocarpus*.

Kungl. Svensk. Vet. Akad. Handl., X, 1 (1931) 279; Van Steenis, in Tijdschr. Kon. Aardrijksk. Genootsch., 55 (1938) 756.

Twigs stout, terete, little branched, the branches more or less verticillate; leaf-scars numerous, prominent, roundish-elliptical, 2—2.5 mm long by 1.5—2 mm broad, vaulted by cushions; scars of the bud-scales long-stretched, 3 mm long by 1 mm broad. Terminal buds large, the part composed by the inner scales nearly ovate-globose, obtuse; outer bud scales reflexed, nearly lanceolate, acute, to 12 mm long; inner scales adpressed, nearly triangular, very short-acuminate or obtuse. Leaves crowded on the youngest 1—3 vegetation periods, all strongly deflexed, thick-coriaceous, very rigid, narrowly linear-lanceolate, gradually narrowed into the indistinct petiole and the very shortly rounded, rarely acute apex, 10—27 cm long by 7—12 mm broad, 12—25 times as long as broad; midrib rather strongly prominent, narrow, sometimes broader, sharply delimited, and indistinct towards the apex above, sharply prominent at the base, broad and flat towards the apex and rather deeply and broadly channelled beneath; lamina slightly to rather strongly recurved, with a narrow shining marginal line beneath, very shining and longitudinally striped above, dull beneath. Male flower buds 1—3 in the upper leafaxils, sessile, subglobose, obtuse; scales broadly ovate-triangular, obtuse, with broad membranous margin. Male flowers unknown. Female flowers solitary in the upper leafaxils; peduncle 9—15 mm long, 1.5 mm thick; receptacle obconical, somewhat flattened, 9—14 mm long, 4—8 mm thick at the apex, composed of 2—4 fleshy bracts, of which 1 or 2 fertile, in the latter case with two small apices between the two fertile scales; seeds 1 or more, usually 2 in number, elliptical-obovate, somewhat narrowed towards the base, 11—12 mm long, 8—9 mm broad. (Description from all the specimens examined.) Cfr. *Fig. 4*.

According to herbarium labels *P. deflexa* is a small tree 5—7 m tall, with the branches spreading at right angles to the stem (Ridley 1925 l. c.). It is common all over the padangs of Gunong Tahan.

According to Ridley this species should be different from *P. neriifolia*, besides in the deflexed leaves, especially in its sessile receptacle and the larger glaucescent fruit. It is at any rate wrong that *P. deflexa* should have sessile receptacles; in reality these are long-peduncled. Probably Ridley based this distinctive character on a twig fragment with two sessile fruits in the cover of the number Wray & Robinson 5452. These fruits however, do not belong to a Coniferous tree. As little is it true that the fruits of *P. neriifolia* do not reach the di-

mensions of those of *P. deflexa*. *P. deflexa*, however, differs too much from *P. neriifolia* by the different terminal bud, the always deflexed leaves, the leaf shape, and the midrib channelled beneath, not to accept it as specifically different.

MALAY PENINSULA. Pahang: Gunong Tahan, 1800—2000 m el., *Wray & Robinson* 5452, first type (S, f); *Ridley* 16024, second type of the species (S, f); *Sing. Field* 7997 coll. *Md. Nur* (S, s); F. M. S. Mus. Herb. 12121 coll. *Kloss* (S, f); *Corner* s. n. (S, m).

14. Podocarpus salomoniensis Wasscher, n. sp.

Ramuli crassi, teretes, cicatricibus magnis. Gemma terminalis magna, perulis e basi rotundata in acumen subulatum productis, ad 11 mm longis, vel a basi sensim attenuatis, ad 22 mm longis. Folia sparsa, divergentia, divaricata, vel reflexa, crasse coriacea, rigida, anguste lineari-lanceolata, versus apicem acutum, versus basin sensim attenuata, 12—18 cm longa, 6.5—8 mm lata, plerumque 8—23 × longiora quam lata, costa facie superiore valde prominente, facie inferiore latiore, basin versus acute costata, apicem versus planiore, nonnunquam leviter sulcata, marginibus valde revolutis, facie superiore lucida, inferiore minus vel minime lucida. Flores masculi et feminei ignoti. Pedunculi fructiferi divergentes, applanati, 11—15 mm longi; foliola subulata, 4 mm longa; receptaculum obconicum applanatum, 8—9 mm longum, prope apicem 8—11 mm latum et 4—5 mm crassum, e squamis 4 decussatis carnosis compositum. quarum 2 fertiles; semen ellipsoides, 11 mm longum, 8 mm latum.

Twigs stout, terete, with coarse leaf scars and striped by decurrent lines. Terminal buds large; bud scales long subulate-acuminate, usually spreading and incurved at the apex, to 11 mm long, or very gradually narrowed, erect, keeled. Leaves scattered on the youngest two vegetation periods, spreading, divaricate or somewhat deflexed, thick-coriaceous, rigid, often somewhat folded upwards along the midrib in the dried state, straight or slightly falcate, narrowly linear-lanceolate, very gradually narrowed into the broad petiole and the acute apex, 12—18 cm long by 6.5—8 mm broad, usually 18—23 times as long as broad; midrib strongly prominent above, on the underside sharply keeled towards the base, broad, thick and flat towards the apex, sometimes somewhat channelled; lamina strongly recurved at the margin, very shining above, more dull beneath. Male flowers unknown. Female flowers solitary in the upper leaf axils; peduncle slender, flattened, spreading, 11—15 mm long; foliola subulate, acute, about 4 mm long; receptacle obconical, somewhat flattened, 8—9 mm long, 8—

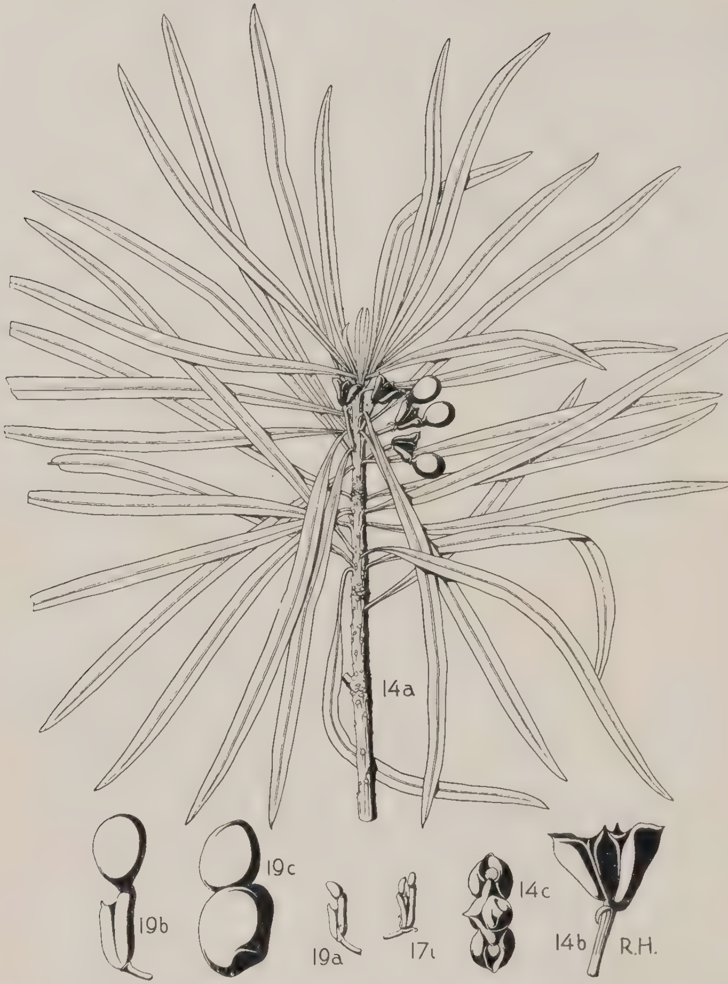

Plate V. Figs. 14a—c: *Podocarpus salomoniensis* (*Brass* 2881); 14a: twig fragment; 14b: receptacle; 14c: receptacle seen from above; 17ι: *P. neriifolia* var. *polyantha*, female flower (*Van Steenis* 3179); 19a—c: *P. polystachya*; 19a: female flower (*Becking* 69); 19b: unripe fruit (*Hort. Bot. Buitenzorg* V.F. 1a); 19c: ripe fruit (*Hort. Bot. Buitenzorg* V.F. 1). Main figure $^2/_5\times$, details $1^1/_5\times$.

11 mm broad by 4—5 mm thick at the apex, composed of 4 decussate fleshy bracts, of which the 2 fertile lower ones larger, with narrow, usually obtuse, free margin and embracing the 2 sterile upper ones, which have prominent apices; seed subelliptical, rounded at the apex, somewhat narrowed towards the base, 11 mm long by 8 mm broad. (Description from the type specimen.) Cfr. *Fig. 4; Plate V, 14a—c.*

According to Brass, *P. salomoniensis* is a tree to 15 m tall, with "spreading and rather drooping branches, thin fibrous, fissured, pale brown bark and hard free grained wood". It is remarkable that most of the folia are inserted somewhat (1—1½ mm) below the receptacle. In leaf and fruit shape, the species mainly agrees with *P. deflexa*, but it differs in the non-deflexed leaves, with the midrib usually not channelled beneath and sharply delimited above.

SOLOMON ISLANDS. San Cristoval Island, Hinuahaoro, in mountain forest, 900 m el., *Brass* 2881 (B, f), type of the species.

15. Podocarpus Koordersii Pilger, in Koorders & Valeton, Bijdr. Booms. Java, 10 (1904) 268; Koorders-Schumacher, Syst. Verz., 1, Fam. 5 (1910) 5; Koorders, Exkursionsfl. Java, 1 (1911) 66; Koorders & Valeton, Atlas Baumart. Java, 3 (1915) ic. 587; Pilger, in Bot. Jahrb., 54, 1 (1916) 39; in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 248; Florin, in Kungl. Svensk. Vet. Akad. Handl., X, 1 (1931) 279, 283; Wasscher, in Backer, Bekn. Schoolfl. Java, 2 (1940) Fam. 18, 2.

Twigs stout, terete, to 3 subverticillate. Terminal buds globose or ovate-globose, obtuse, 2—4 mm in diam.; bud scales adpressed, mostly ovate or roundish, obtuse, to 3 mm long, thick, strongly carinate, with very narrow membranous margin, the outer ones sometimes somewhat acute. Leaves rather remote, spreading or erect-spreading, thick coriaceous, rigid, straight or somewhat falcate, linear-lanceolate, with the margins parallel over a great part of the length, rather gradually or very gradually narrowed into the broad and thick petiole, rather gradually narrowed into the acute apex, 13—21 cm long by 9—13 mm broad on the flowering twigs, up to 24 cm long and 18 mm broad on the sterile twigs, 12—24 times as long as broad; midrib broad, roundly prominent or prominent as a rather thick line, and slightly keeled towards the apex above, sharply prominent at the base, thick and flat towards the apex beneath; lamina slightly recurved at the margins, very shining above, dull beneath. Male flower buds 3—7 in the leaf axils, sessile, globose or ovate-globose, obtuse, to 3 mm long and 2 mm broad; bud scales ovate, obtuse, with membranous margin, the outer

scales somewhat ovate-triangulate, keeled; flowers narrow-cylindrical, 3—4.5 mm long by 2.5—3 mm in diam.; stamens with short, broad-triangulate, rather obtuse apiculus. Female flowers and fruits unknown. (Description from all the specimens examined.) Cfr. *Fig. 4.*

This species differs from *P. neriifolia* in the round, obtuse leaf buds, the thick coriaceous, linear-lanceolate leaves with the margins parallel, the different shape of the midrib, and the male flowers in bundles of 3—7. In *P. Rumphii*, which it resembles most, the male flowers are solitary. A plant from the Andaman Islands (King's collector 301) (B, m) was included in this species by Koorders and Valeton, but, in my opinion, wrongly. Whether this plant is a form of *P. neriifolia*, I cannot say with certainty.

JAVA. Noesa Kambangan, 50 m el., *Koorders* 1230, v.n.: merakan (B, L, s); 39480 (B, L, m); 39599, v.n.: tjemara (B, L, m); for. no. 1097*, herb. no. 40251, v.n.: tjemara pasir (B, L, m); all these specimens originals of the species.

16. **Podocarpus Rumphii** Blume. — *Lignum emanum* Rumphius, Herb. Amboin., 3 (1743) 47, t. 26. — *Cerbera nereifolia* Zippelius, ex Macklot, Bijdr. Nat. Wet., 5 (1830) 178, nomen. — *Podocarpus Rumphii* Blume, Rumphia, 3 (1847) 214; Walpers, Ann. Bot. Syst., 3 (1852) 449; Miquel, Fl. Ind. Bat., II, 6 (1859) 1073; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 393; De Boer, Conif. Arch. Ind. (1866) 15, 28, 36, 37, 50; De Sturler, Cat. descr. Esp. Bois (1867) 6; Carrière, Traité gén. Conif., II, ed. 2 (1867) 663; De Kirwan, Conif., 2 (1868) 228; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 515; Gordon, Pinetum, ed. 2 (1875) 346; Filet, Plantk. Woordenb. (1876) 182; Scheffer, in Ann. Jard. Bot. Buitenz., 1 (1876) 52; Beccari, Malesia, 1 (1878) 179; Van Eeden, Houts. Ned. Ind. (1886) 136; ed. 3 (1906) 256; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1887) 104; Warburg, in Bot. Jahrb., 13 (1891) 256; Monsunia, 1 (1900) 192; Schumann & Lauterbach, Fl. deutsch. Schutzgeb. (1901) 155 p.p.; Smith, in Teysmannia, 12 (1902) 162; Pilger, in Engl., Pflanzenr., IV, 5 (1903) 81; Foxworthy, in Philipp. Journ. Sci., 2 (1907) 258; De Clercq, Plantk. Woordenb. (1909) 309; Foxworthy, in Philipp. Journ. Sci., 6 (1911) 164; Pilger, in Bot. Jahrb., 54, 1 (1916) 39; 54, 3 (1916) 210; Gibbs, in Contr. Arfak Mts. (1917) 82, 27, 28, 29; Merrill, Interpr. Rumph. Herb. Amb. (1917) 75; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 248; Heyne, Nutt. pl. Ned. Ind., ed. 2 (1927) I, 109; Dakkus, in Bull. Jard. Bot. Buitenz., sér. 3, suppl. vol. 1 (1930) 237; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 280, 283; Lauterbach, in Bot. Jahrb., 63 (1930) 438, 447. — *Podocarpus bracteata* (non Blume) Dietrich, Syn. Plant.,

5 (1852) 446; Hasskarl, Neue Schlüssel Rumph's Herb. Amb. (1866) 49. — *Nageia Rumphii* F. von Mueller, Descr. not., 1 (1875) 93; Kuntze, Rev. Gen. Plant., 2 (1891) 800. — *Podocarpus Blumei* (non Endlicher) Koorders, Dienstr. Minah. (1898) 264. — *Podocarpus philippinensis* Foxworthy, in Philipp. Journ. Sci., 6 (1911) 163, t. 30; Merrill, Enum. Philipp. Flow. Pl., 1 (1923) 3; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 248; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 280, 283. — *Podocarpus neriifolia* Koorders-Schumacher, Syst. Verz., 3 (1914) 7 p.p.

Twigs several (up to 5) subverticillate, sometimes more scattered, spreading, terete, more angulate between the leaves. Terminal buds either globose to ovate-globose, obtuse, or ovate-acute to conical; bud scales either ovate to broad-ovate, obtuse, the outer ones sometimes somewhat acute, 2—3 mm long, thick, keeled, sometimes with narrow, membranous margin or very thick triangular-subulate, or ovate-triangulate and subulate-acuminate, 3—13 mm long, keeled, sometimes with narrow membranous margin, the inner ones shorter, ovate-triangular, acute. Leaves usually not much crowded, but sometimes slightly so towards the apices of the vegetation periods, in young plants sometimes turned in two rows, more or less spreading, straight or subfalcate, on adult trees thick coriaceous, rigid, linear-lanceloate, with the margins parallel over a great part of the length, rarely somewhat more lanceolate, cuneate or rather gradually narrowed into the short up to 1 cm long petiole, usually shortly, sometimes abruptly, rarely more gradually narrowed into the acute apex, 6—23 cm (usually 9—19 cm) long by 8—23 mm (usually 10—17 mm) broad, 8—17 times as long as broad; midrib on the upper surface slightly impressed in the apical portion, flat or more or less prominent in the basal portion, in the latter case either rounded or with a prominent sharp line, on the lower surface sharply keeled towards the base, more flat towards the apex; lamina with flat or slightly recurved margins, shining above, more dull beneath; in sterile, perhaps young plants, the leaves are often somewhat more gradually narrowed and sometimes slightly acuminate towards the apex, to 31 cm long and to 30 mm broad, sometimes relatively shorter, the midrib often very narrow, sharply keeled above. Male flower buds single in the leaf axils, sessile, subglobose; bud scales ovate, obtuse, the 2 outer ones acute and strongly keeled; flowers narrowly cylindrical, 4 cm long (on cultivated plants to 8 cm), 3 mm in diam.; stamens with nearly ovate-triangular, rather acute apiculus. Female flowers rather remote, on short or rather long,

thick, often somewhat flattened, spreading peduncles; receptacle composed of 2—4 fleshy bracts, of which 1—2 fertile, the sterile ones with short, obtuse or acute apex, the fertile bracts with narrow, obtuse free margin. Peduncle 2—10 mm (rarely to 16 mm) long, 1—1.5 mm broad; foliola subulate, to 3 mm long; receptacle cylindrical or obconical, 6—10 mm long by 3.5—7 mm in diam.; seeds 1—2, globose or elliptical, rounded or somewhat narrowed towards the base, rounded towards the apex, 10—13 mm long by 7—11 mm broad. (Description from all the specimens listed below.) Cfr. *Fig. 4.*

According to herbarium labels *P. Rumphii* is a small or moderate-sized tree up to 30 m tall, of which the crown usually occupies about one half. As a rule, the diameter of the bole is about 50 cm (Koorders to his no. 16537 gives a diam. of 200 cm, but I believe here the girth of the bole is meant). The bast yields some red-yellow sap. The male flower is pale green (Clemens 2352), the female ones are purple (Boschpr. Cel./II. 286), whereas the fruit is green with a powdery cover and is said to be eaten by birds and monkeys. The species occurs from sea level to 1650 m el. The timber is used for house-building, and making furniture and eating utensils.

P. Rumphii differs from *P. neriifolia* in the usually thicker and more abruptly narrowed leaves, of which the margins are parallel, whereas in adult trees the midrib of the leaves is slightly rounded-prominent or not all prominent, and slightly impressed towards the apex. The number of fertile scales in the female flowers is often more than one.

The description above differs in some respects from those by other authors. With rather great certainty it may be said, that the plants from Ambon mentioned below agree with Rumphius' *Lignum emanum*, as we read: "Sunt enim octo decemque pollices longa, transversum digitem lata, crassiuscula et firma obscure viridia, ipsorumque apices ad unam plerumque inclinant partem, levemque gerunt sulcum loco nervi medii, nec ullas notabiles costas." The leaves are, however, usually longer than Rumphius has pictured. The impressed of little prominent midrib is, together with the leafshape, one of the most important characters of the adult leaves of *P. Rumphii*. Blume (1847) and, with him, Miquel (1859) and De Boer, give the following diagnosis of the leaves, based on plants from Ambon and New Guinea (Lobo, Zippelius), which I had not the opportunity to examine: "Folia 5—10 poll. longa, 7—11 lin. lata, elongato-lanceolato-linearia, nervo medio subtus acute supra applanato-v. obtuse prominulo subcarinata apice acute v. acuminato-

angustato subpungentia v. sphacelato-obtiuscula". Parlatore (1868) writes: "Foliis ...... late lanceolatis acuminatis, ... supra nervo longitudinali prominente ...... Folia ...... 15—24 cent. longa, 18—23 mill. lata", whereas Pilger (1903) writes: "Folia lanceolata, superne breviter angustata et ± subcaudato-acuminata, rarius fere aequaliter longe acuminata, acuta, medianus supra obtuse prominulus vel medietate linea magis elevata, acute notatus." The observation of Pilger on the acute prominent midrib must be based upon the leaves of young plants. The collection Teysmann s. n. from Misoöl, Praetorius s. n. and Lauterbach 2446, from New Guinea, and Koorders 16534, from Celebes, which show the same peculiarity, moreover usually have very large leaves, which are sometimes shortly acuminate towards the apex. The specimens Teysmann s. n. from Misoöl, and Boschpr. b.b. 24306 from the Tanimber Islands have longer attenuate leaves. In some of these specimens the midrib is already much less prominent, more rounded and broad towards the base. These plants form a transition towards the other sterile plants, which have likewise broad, but always shortly narrowed leaves, whereas the midrib in these leaves is towards the base like in the former plants, towards the apex, however, little or not at all prominent, and in the uppermost part of the leaves often slightly impressed. I never met with caudate-acuminate leaves, a character used for the distinction of species by Pilger. Beccari collected this species in Ambon, the Kei and Aroe Islands, and New Guinea. I did not see a single of these plants. According to him, it is not impossible, that the name *P. Rumphii* must be placed among the synonyms of *P. bracteata,* together with *P. neglecta* and *P. Teysmannii.* We may, however, assert with certainty, that some of his collections do not belong to *P. Rumphii,* as from Ambon he mentions plants with leaves 1—2.5 cm long and 3—5 mm broad. Though on the one hand it is a fact, that the typical plants of *P. Rumphii* and *P. neriifolia* (= *P. bracteata*) are very different, it must be acknowledged, that the limit between these species is not very sharp, and that there exist intermediate forms. Especially the collections Teysmann 14068, b.b. 9705, De Vriese & Teysmann s. n., and Teysmann 7815 p.p. point towards *P. neriifolia,* as the midrib is rather strongly prominent and sharply delimited, as in the latter species. Sometimes the leaves are also more gradually narrowed towards the apex. The margins of the leaves, however, are always parallel.

The terminal bud is always said to be globose-ovate; only Beccari mentions, that the bud scales are always acute. In the fertile materials, examined by me, different forms of leaf buds may be distinguished.

All the plants from Ambon have very solid, subulate, acute bud scales, those from Malili (Celebes), and Clemens 2352 from New Guinea, subulate-acuminate ones. All the other fertile plants, however, have globose, obtuse terminal buds.

The specimens Boschpr. Cel./II. 285, 286, 288 and 325, all from Malili, have very small leaves, *viz.*, 7—10 cm long by 7—9 mm broad, and usually more lanceolate. For the rest there are no other differences, whereas moreover the specimens Cel./II. 287 and b.b. 23265 from the same locality are nearly intermediate between the former plants and the typical, fertile plants.

Most of the plants collected in the Minahassa by Koorders have leaves which are only 6—9 times as long as broad.

Of the specimen Gibbs 5985 (from New Guinea, Arfak Mts, at ca. 2300—3000 m el.), I only saw a single leaf, which was included in *P. Rumphii* by Gibbs, 1917 l. c., but which does not convince me of the correctness of Gibbs' determination.

PHILIPPINES. Luzon: Bataan prov., Limay Peak, *Bur. Sci.* 5174 coll. *Foxworthy*, originals of *P. philippinensis* (B, f); Mt. Mariveles, Lamao, *For. Bur.* 2743 coll. *Borden* (B, S, s); *For. Bur.* 8987 coll. *Curran* (B, f); *For. Bur.* 6326 coll. *Curran* (B, f); Mt. Arayat, *For. Bur.* 17664, 17723 coll. *Curran* (ex *Foxworthy* 1911, l. c.); Ilocos Sur (ex *Merrill* 1923, l. c.); Mindoro (ex *Foxworthy* 1911, l. c.).

BORNEO. Without further locality, *De Vriese* s. n. (B, s); British North Borneo: P. Selangan, Semporna, 60 m el., *For. Dep.* Br. N. Borneo 4146 coll. *Orolfo*, v.n.: kayu china (S, f); *For. Dep.* Br. N. Borneo 4083 coll. *Mail*, v.n.: kayu china (S, f).

CELEBES. Without further locality, *De Vriese & Teysmann* s. n., v.n.: marama (L, s); Minahassa, near Tondano, 900 m el., *Koorders* for. no. 1425*, herb. no. 16534, v.n.: marama (B, L, s); forest Lolomboelan near Pakoeoere, 450 m el., *Koorders* for. no. 2679*, herb. no. 16535, v.n.: marama (B, L, f); G. Klabat, 1000—1300 m, *Koorders* for. no. 772*, herb. no. 16536 (B, s); Lembean, Tondano, 800 m el., *Koorders* for. no. 2874*, herb. no. 16537, v.n.: marama (B, L, s); Pinamorangan, 500 m el., *Koorders* for. no. 950*, herb. no. 16538, v.n.: malambik (B, L, s); subdiv. Malili, Tabarano, 600 m el., *Boschpr.* b.b. 9705, v.n.: sandoe (B, L, s); subdiv. Malili, Oesoe, 200—300 m el., *Boschpr.* Cel./II. 285, v.n.: kajoe sandoe motoetoe (B, f); Cel./II 286 (B, f), 287 (B, s), 288 (B, f), 325, v.n.: sanroe (B, L, f); subdiv. Malili, Pasi Manangoei, 10 m el., *Boschpr.* b.b. 23263, v.n.: kajoe sandroe (B, s); Loka-Bantaèng, *Teysmann* 14068 (B, L, s); S.E.- Celebes, Staring-baai, *Pella* 55, v.n.: tjina (B, f); Singkobale near Towoeli Lake, 300 m el., *Kjellberg* 3973 (B, s).

LESSER SUNDA ISLANDS. Soemba: Tarimbang, *Teysmann* 8832 (B, s); Timor: *Boschpr.* b.b. 6889, v.n.: adjaub nasi (B, s).

MOLUCCAS. Batjan: G. Sibéla, *Warburg* 18245, 18271 and 18284 (ex *Warburg* 1900, l. c., but the first and the latter according to *Pilger* 1903, l. c. *P. neriifolia*); Obi: *Atasrip* 40 (B, L, s); Wooi, 30 m el., *Boschpr.* b.b. 23830, v.n.: kasuari goenoeng, or mamoeliti (B, f); P. Gebé: *Teysmann* 7815 (B, s); Misoöl:

Waigama, *Teysmann* s. n., two different collections (see discussion) (B, L, s); Kaleketmelis, 40 m el., *Boschpr.* b.b. 14385, v.n.: manoelit (B, L, s); Ambon: *Rumphius* (ex *Rumphius* 1743, l. c.); Hoetoe Mortetoe (ex *Smith* 1902, l. c.); G. Salhoetoe (ex *Beccari* 1877, l. c.); Ambon, *Robinson* 309 (B, L, s); G. Hori, Ema, *Teysmann* s. n., v.n.: assoijer (B, L, s); G. Salhoetoe, *Teysmann* s. n. (B, L, m); *Boerlage* 174 (B, s); Hoetoemoeri, *Teysmann* s. n. (B, s); Waai, 120 m el., v.n.: asoër (B, s); Tanimber Islands: Ilgnei-Otimmer, *Boschpr.* b.b. 24306, v.n.: kajoe tjina (B, s); Kei Islands: Groot Kei, cult. in *Hort. Bot. Buitenzorg,* sub no. V F. 20, 20a (B, s); Weri (ex *Beccari* 1877, l. c.); Aroe Islands: Giabu-lengan (ex *Beccari,* l. c.).

NEW GUINEA. Without further locality, *Pr(aetorius)* s. n. (L, s); N.W. Part: Kapaor, Soron and Arfak Mts., Putat (ex *Beccari,* l. c.); Lobo, *Zippelius* s. n. (ex *Blume* 1847, l. c.); Humboldt-baai, Mt. Cycloop, 1550 m el., *Dumas* 10 (B, s); N.E. Part: Suor-Mana, 600 m el., *Lauterbach* 2320 (ex *Pilger* 1903, l. c.); River A, 300 m el., *Lauterbach* 2446 (BD, s); Morobe distr., Yunzaing, 1300—1650 m el., *Clemens* 2352 (BD, m).

Cultivated: in Hort. Bot. Buitenzorg, V. F. 9a from unknown provenance (B, m); V. F. 31, 31a (B, G, f); V. F. 94 (B, m), all from the Moluccas.

17. **Podocarpus neriifolia**[1]) D. Don, in Lambert, Genus Pinus, ed. 1 (1824) 21; [1]) ed. 2 (1828) II, 122, p.p. (excl. *P. polystachya* et *P. Rumphii*); [1]) Prodr. fl. nep. (1825) 55; Mirbach, in Mém. Mus. hist. nat., 13 (1825) 47, 75; Sprengel, Syst. veg., 3 (1826) 889 (excl. syn. *Lignum emanum*); [1]) Bennett, in Horsfield, Pl. Jav. rar. (1838) 40; [2]) Hasskarl, Cat. Plant. Hort. Bot. Bog. (1844) 70; Endlicher, Syn. Conif. (1847) 215; Parlatore, in Bot. Mag., 78 (1852) t. 4655; Dietrich, Syn. Plant. 5 (1852) 446; Hooker f., Him. Journ., 1 (1854) 256; Walpers, Ann. Bot. Syst., 5 (1858) 800; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 381; Carrière, Traité gén. Conif., II, ed. 2 (1867) 661; [1]) De Kirwan, Conif., 2 (1868) 228; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 514; Brandis, For. Fl. (1874) 541; Gordon, Pinetum, ed. 2 (1875) 343; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1887) 104; Hooker f., Fl. Br. Ind., 5, 3 (1888) 649 (excl. syn. *P. polystachya* et *Lignum Emanum*); Stapf, in Transact. Linn. Soc., sér. 2, Bot., 4 (1894) 249; Warburg, Monsunia, 1 (1900) 193; Kent, in Veitch's Man. Conif. (1900) 152; Gamble, Man. Ind. Timb. (1902) 702, t. 16, ic. 2; Forbes & Hemsley, Journ. Linn. Soc., 26 (1902) 548; [2]) Pilger, in Engl., Pflanzenr., IV, 5 (1903) 80; Koorders & Valeton, Bijdr. Booms. Java, 10 (1904) 265; [2]) Perkins, Fragm. Fl. Phil., 1 (1904) 44; Van Eeden, Houts. Ned. Ind., ed. 3 (1906) 256; Brandis, Ind. Trees (1906) 695; [3]) Merrill, in Philipp. Journ. Sci., 1, suppl. 1 (1906) 24; [2]) Foxworthy, in Philipp. Journ. Sci., 2 (1907) 258; De Clercq, Plantk. Woordenb. (1909) 309; Gibbs, in Journ. Linn. Soc., 39 (1909) 183; [2]) Koorders-Schumacher, Syst. Verz., 1, Fam. 5 (1910) 4; 3 (1914) 7, p.p.; [2]) Fox-

worthy, in Philipp. Journ. Sci., 6 (1911) 162; [2]) Ridley, in Journ. Str. Br. Roy. As. Soc., 60 (1911) 57; Koorders, Exkursionsfl. Java, 1 (1911) 65, ic. 3; [2]) Robinson, in Philipp. Journ. Sci., 6 (1911) 192; Hayata, in Journ. Coll. Sci. Imp. Univ. Tokyo, 30, 1 (1911) 307; Dunn & Tutcher, in Kew Bull., add. sér., 10 (1912) 256; Pearson, Commerc. Guide For. Econ. Prod. Ind. (1912) 79; Gibbs, in Ann. Bot., 26 (1912) 549, t. 51, ic. 48—51, t. 53, ic. 78; [2]) Stiles, in Ann. Bot., 26 (1912) 453; Hallier, in Meded. Rijks Herb. Leiden, 14 (1912) 34; [2]) Koorders, in Bot. Jahrb., 50, Suppl. Band (1914) 297; in Nova Guinea, VIII, 2 (1914) 616; Boldingh, Cat. Herb. Pl. Hort. Bot. Bog. (1914) 4; Koorders & Valeton, Atlas Baumarten, 2 (1915) ic. 589; [2]) Pilger, in Bot. Jahrb., 54, 1 (1916) 38; 54, 3 (1916) 210; von Wiesner, Rohst. Pflanzenr., ed. 3, II (1918) 362; Beekman, in Meded. Proefst. Boschw., 5 (1920) 171, t. 56; Lörzing, in Trop. Nat., 10 (1921) 99; [2]) Merrill, Bibl. enum. Born. pl. (1921) 31; Koorders, Fl. Tjibodas, I, 2 (1922) 3; Seifritz, in Bull. Torrey Bot. Club, 50 (1923) 292; [2]) Merrill, Enum. Philipp. Flow. pl., I, 1 (1923) 3; [2]) Ridley, in Journ. Bot., 63 (1925) suppl. 127; [2]) Lane-Poole, For. res. Papua (1925) 73, 23, 26, 27, 34, 40, 50, 64, 72; [2]) Ridley, Fl. Mal. Pen., 5 (1925) 281; [2]) Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 247; Heyne, Nutt. pl. Ned. Ind., ed. 2 (1927) I, 109; Van Steenis, in Trop. Nat., 17 (1928) 206; [2]) Dakkus, in Bull. Jard. Bot. Buitenz., sér. 3, suppl. vol., 1 (1930) 237; Van Steenis, in Trop. Nat., 19 (1930) 89; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 76, 279, 283, ic. 7, t. XXX, 2, 3; [2]) Hickel, in Lecomte, Fl. gén. Indo-Chine, V, 10 (1931) 1069; [2]) Witkamp & Posthumus, Versl. Ned. Ind. Ver. Nat. besch. (1932) 81; Van Steenis, in Bull. Jard. Bot. Buitenz., sér. 3, XIII, 1 (1933) 12, 20; [2]) Merrill, in Contr. Arn. Arb., 8 (1934) 15; in Proc. Fifth Pac. Sci. Congr. Can., 4 (1934) 3269; [2]) H. H. Hu, in Proc. Fifth Pac. Sci. Congr. Can., 4 (1934) 3273, 3283, 3284, 3286; Kawada, in Proc. Fifth Pac. Sci. Congr. Can., 4 (1934) 3297; Steup, in Trop. Nat., 23 (1934) 63; [2]) Burkill, Dict. Econ. Prodr. Mal. Pen., 2 (1935) 1779; Janssonius, Mikrographie, 13 (1936) 491; [2]) Pilger, in Bot. Jahrb., 68 (1936) 491; Van Steenis, in Tijdschr. Kon. Ned. Aardr. Gen., 55 (1938) 762; Docters van Leeuwen, in Nat. Wet. Tijdschr., 21 (1939) 833; Hoogerwerf, 11e Versl. Ned. Ind. Ver. Natuurbesch. (1939) 263; Wasscher, in Backer, Bekn. Fl. Java, 2 (1940) Fam. 18, 3. — *Podocarpus bracteata* Blume, Enum. Pl. Jav., 1 (1827) 88; Bennett, in Horsfield, Pl. jav. rar. (1838) 40; [4]) Hasskarl, Cat. Plant. Hort. Bot. Bog. (1844) 70; Endlicher, Syn. Conif. (1847) 216; Blume, Rumphia, 3 (1847) 214, t. 172, ic. 1; Junghuhn, Java, 1

(1851) 507, 546; Miquel, Pl. Junghuhn., 1 (1851) 2; Fl. Bat. Ind., II, 6 (1859) 1072; Walpers, Ann. Bot. Syst., 3 (1852) 449; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 391; Seemann, Fl. vitiensis (1865—1873) 266; Teysmann & Binnendijk, Cat. Plant. Hort. Bot. Bog. (1866) 14; De Boer, Conif. Arch. Ind. (1866) 16, 28, 35, 36, 37, 42; Carrière, Traité gén. Conif., ed. 2, II (1867) 662; De Kirwan, Conif., 2 (1868) 228; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 515; Gordon, Pinetum, ed. 2 (1875) 328; Filet, Plantk. Woordenb. (1876) 3, 180, 182; Van Eeden, Houts. Ned. Ind. (1886) 135; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1887) 104; Warburg, Monsunia, 1 (1900) 192; Koorders, in Nat. Tijdschr., 62 (1902) 216; Gibbs, in Ann. Bot., 26 (1912) 548, t. 51, ic. 44—47. — *Podocarpus bracteata* var. *brevipes* Blume, Rumphia, 3 (1847) 214; Miquel, Pl. Junghuhn., 1 (1851) 2; Walpers, Ann. Bot. Syst., 3 (1852) 449; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 392; Carrière, Traité gén. Conif., ed. 2 (1867) II, 662; De Kirwan, Conif., 2 (1868) 228; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 515. — *Podocarpus neglecta* Blume, Rumphia, 3 (1847) 213; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 396; De Boer, Conif. Arch. Ind. (1866) 21, 28, 35, 36, 37, 42, 43, t. II, 2; Carrière, Traité gén. Conif., ed. 2, II (1867) 668; De Kirwan, Conif., 2 (1868) 228; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 516; Gordon, Pinetum, ed. 2 (1875) 342; Filet, Plantk. Woordenb. (1876) 180; Van Eeden, Houts. Ned. Ind. (1886) 135; Warburg, Monsunia, 1 (1900) 193. — *Podocarpus discolor* Blume, Rumphia, 3 (1847) 213; Walpers, Ann. Bot. Syst., 3 (1852) 449; Miquel, Fl. Ind. Bat., II, 6 (1859) 1074; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 396; De Boer, Conif. Arch. Ind. (1866) 23, 28, 35, 36, 37, t. III, 1; Carrière, Traité gén. Conif., ed. 2, II (1867) 669; De Kirwan, Conif., 2 (1868) 229; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 518; Gordon, Pinetum, ed. 2 (1875) 333; Filet, Plantk. Woordenb. (1876) 182; Eichler, in Engl. & Pr., Nat. Pflanzenfam., II, 1 (1887) 104; Warburg, Monsunia, 1 (1900) 193. — *Podocarpus leptostachya* Blume, Rumphia, 3 (1847) 214; Walpers, Ann. Bot. Syst., 3 (1852) 449; Miquel, Fl. Ind. Bat., II, 6 (1859) 1073; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 392; De Boer, Conif. Arch. Ind. (1866) 19, 28, 36, 37, t. II, 1; Carrière, Traité gén. Conif., ed. 2, II (1867) 663; De Kirwan, Conif., 2 (1868) 229; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 515; Gordon, Pinetum, ed. 2 (1875) 339; Warburg, Monsunia, 1 (1900) 193. — *Podocarpus Junghuhniana* Miquel, in Pl. Junghuhn., 1 (1851) 2; Junghuhn, Java, 1 (1851) 507; Miquel, Fl. Ind. Bat., II, 6 (1859) 1073; Teysmann &

Binnendijk, Cat. Plant. Hort. Bot. Bog. (1866) 14; Filet, Plantk. Woordenb. (1876) 180; Vidal, Sinopsis Atlas (1883) 43, t. 97, ic. C. — *Nageia bracteata* F. von Mueller, Descr. Not. Pap. pl., 1 (1875) 93; Kuntze, Rev. Gen. Plant., 2 (1891) 800. — *Nageia discolor, N. neglecta, N. leptostachya, N. neriifolia* Kuntze, Rev. Gen. Plant., 2 (1891) 800. — *Podocarpus neriifolius* var. *brevipes* Pilger, in Engl., Pflanzenr., IV, 5 (1903) 81; Foxworthy, in Philipp. Journ. Sci., 6 (1911) 163. — *Podocarpus polystachyus* (non R. Brown) Lauterbach, in Bot. Jahrb., 44 (1910) 517; Hub. Winkler, in Bot. Jahrb., 50 (1914) Suppl. Band, 204; Ridley, in Journ. Bot., 63, suppl. (1925) 127. — *Podocarpus amarus* (non Blume) Ridley, in Journ. Bot., 63, suppl. (1925) 127 p.p.; Merrill, in Contr. Arn. Arb., 8 (1934) 14. — *Podocarpus Rumphii* (non Blume) Pilger, in Bot. Jahrb., 68 (1936) 246.

[1]) *P. nereifolia,* [2]) *P. neriifolius,* [3]) *P. neriifolium,* [4]) *P. bractcatus.*

Twigs usually several (up to 5) subverticillate, sometimes more scattered, spreading, terete, rather slender. Terminal buds usually ovate-acute or narrow-conical, with the bud scales ovate-triangular and usually long-subulate-acuminate, often with the apex curved outwards, sometimes (in the var. *atjehensis*) entirely deflexed, or very gradually narrowed into the acute apex, erect, 2—20 mm long, usually keeled and sometimes with a narrow membranous margin; sometimes (in the var. *linearis*) ovate, obtuse, with ovate, obtuse or broadly truncate, 3—4 mm long bud scales, or (in the var. *Teysmannii*) subglobose, with ovate-triangular, ovate or orbicular, usually obtuse, up to 3 mm long bud scales, or (in the var. *membranacea*) large, ovate to ovate-conical, with narrowly ovate, rarely acute, entirely membranous, up to 13 mm long bud scales. Leaves scattered, usually rather remote, sometimes more crowded, usually spreading, sometimes erect-spreading, rarely (in the var. *atjehensis*) deflexed, thin-coriaceous and rather flexible, sometimes thicker and more rigid, straight or slightly falcate, narrowly to broadly lanceolate, sometimes (especially in the var. *linearis*, and less strongly in the varieties *polyantha, Teysmannii* and *bracteata*) with the margins parallel, gradually or sometimes more cuneately narrowed into the short or hardly distinct petiole, usually very gradually, sometimes more abruptly narrowed into the acute, rarely mucronate apex, sometimes slightly acuminate, or (in the varieties *Teysmannii* and *polyantha*) more abruptly narrowed and shortly acuminate, 3—24 (usually 7—16) cm long by 5—28 (usually 8—14) mm broad, 3—20 (usually 7—13) times as long as broad; midrib on the upper surface usually strongly prominent, narrow, sharply

delimited, sometimes, especially towards the base, even by means of a furrow on each side, or (in the varieties *Ridleyi* and *timorensis*) not very distinct, flat or slightly impressed, or slightly prominent as a narrow line, on the lower surface sharply keeled towards the base, more flattened towards the apex, rarely slightly channelled or (especially in the var. *polyantha*) with a rather deep furrow; lamina with flat or slightly recurved margins, shining above, more dull beneath. Male flower buds single or in bundles of 2—3 (rarely to 4) in the leaf axils, sessile or rarely on very short, 1—4 mm long, common peduncles, usually small, globose, obovate or ovate, obtuse, sometimes (in the var. *linearis*) larger, ovate-obtuse, or (in the varieties *bracteata, membranacea* and *atjehensis*) large and ovate-acute; bud scales usually adpressed, ovate-obtuse or orbicular, the outer ones sometimes more ovate-triangular and keeled, usually to 2 mm long, or sometimes (in the varieties *bracteata* and *atjehensis*) somewhat spreading, ovate-triangular, acute, to 7 mm long or (in the var. *membranacea*) entirely membranous. Male flowers cylindrical, sometimes nearly filiformous, 2—8.5 cm long by 2.5—3.5 mm in diam. (in the varieties *timorensis* and *atjehensis* up to 4.5 mm); stamens with ovate-triangular, short or rather long, rather obtuse or acute apiculus; pollen grains with 2 air bladders. Female flowers single in the leaf axils, rather remote, usually over a rather short distance on the youngest vegetation period, sometimes (especially in the var. *polyantha*) very numerous all over the youngest vegetation period; peduncles spreading, usually rather long and slender, sometimes shorter, often slightly flattened towards the apex; receptacle composed of 2 fleshy bracts with 1 ovule, rarely (in the var. *polyantha*) of 2—4 fleshy bracts with 1—2 ovules. Peduncles 3—24 (usually 8—20) mm long, sometimes (in the varieties *polyantha* and *Ridleyi*) very short; foliola subulate, 1.5— 6 mm long; receptacle cylindrical or obconical, 5—11 mm long by 2—7 mm thick, the sterile bract usually with a short acute apex, the fertile one with a narrow, free margin; seed elliptical, ovate-elliptical or elliptical-globose, obtuse, often somewhat narrowed towards the base, 9—12 mm long and 6—9 mm broad. (Description from all the specimens mentioned below including the varieties.) Cfr. *Fig. 4.*

According to herbarium labels, *P. neriifolia* is usually a moderate-sized tree, up to 40 m tall, rarely (Boschpr. b.b. 15914 from Schouten Island) up to 60 m tall; the bole is rather stout, with a diam. up to 80 cm (according to Koorders 16533 up to 160 cm, but, in my opinion, the girth is meant here) and without buttresses, but once (Brass 5907) "slightly spured at the base". The crown usually amounts to over

one-third to one-half of the total height. Sometimes (Boschpr. b.b. 20061) the bark appears to yield no sap, sometimes (b.b. 15914, b.b. 21933) little yellow sap, sometimes (b.b. 22455) much yellow sap. The young leaves are "red, conspicuous at a distance" (Clemens 50051), or light brown (Van Steenis 4127); the older leaves are dark green, pale wine-red towards the apex (Koorders 1252). The receptacle is very pale green (Koorders 39401), green (Koorders 1255), orange-yellow (Koorders 16533), red (Clemens 2276), or pale-yellow (Brass 5907), whereas the fruit is bluish pruinose (Boschpr. b.b. 17030), green (b.b. 8823, Clemens 50051), glaucous (Koorders 39401), blue-grey (Koorders 1229), bluish green (Koorders 16533), pale sea-green (Clemens 5434), yellowish (Clemens 2276), or brownish-green (Brass 5907).

The species occurs from sea level up to 2840 m el., usually in mountain forests, sometimes (Sing. Field no. 32288) in swampy forest, in shrub formations at high el. (Boschpr. b.b. 17030 from Sumatra), or along the sea shore (Boschpr. b.b. 20061 from Schouten Island). The wood is used for house-building and for making furniture (Java, Minahassa, Schouten Island) and proas (Schouten Island).

From Java three species were described by Blume, *viz.*, *P. bracteata*, *P. neglecta* and *P. discolor*. To these, Miquel added *P. Junghuhniana*, but this species was united with *P. neglecta* by De Boer. Pilger united *P. neglecta* with *P. bracteata*, and the latter (in this following Hooker, but wrongly according to Warburg), with *P. neriifolia* from Nepal. Also *P. discolor* and *P. leptostachya*, the latter from Borneo, were united with this species by Pilger provisionally. Koorders and Valeton were of one accord in uniting *P. neglecta* with *P. bracteata*. They write (translated from the Dutch, l. c. p. 266): "Some specimens differ in the much smaller, only 45—110 cm long leaves. These specimens undoubtedly belong to *P. neglecta* Bl. But there are, however, so many transitions between these specimens and the type, sometimes even on the same tree, that it seems impossible to us to distinguish them even as a variety. Indeed, already when we compare De Boer's description and picture of *P. neglecta* with Blume's *P. bracteata*, it is evident, that there cannot be a question of specific differences here." Indeed also to me it has appeared impossible, to indicate distinct differences between these two forms as regards the shape and size of the leaves. The female flowers and the fruits do not give any indication either. On the other hand, the differences in the male flowers are too large to pass them by silently. In the entirely developed flowers, however, these differences can hardly be seen any more. Former authors usually

describe the entirely developed flowers, but rarely the flower buds. Of *P. bracteata* Blume says: "Gemmae amentorum masculorum ...... ovoideae, squarrosae, e squamis imbricatis ovatis acuminatis subcarinatis chartaceis vegeto-persistentibus compositae." For *P. neglecta* he gives the following diagnosis: "Amenta antherifera in pedunculis brevibus axillaribus solitariis fasciculata, in juventute squamis perulisve rotundatis concavis membranaceis". Miquel describes *P. Junghuhniana* in the following way: "Gemmae masculae vulgo ternae, arcte confertae, sessiles, obovato-globosae, ima basi bractea lanceolata utrinque solitaria caduca instructae, caeterum bracteis rotundatis margine scariosis nitidis, viscosis? dense imbricatae". In the collections examined by me, flower buds, as described in *P. bracteata*, were found only in plants from Java. In these the buds are large and acute, up to 8 mm long and 4 mm broad; the leaves are rather large and often somewhat linear-lanceolate, 10—17 cm long by 9—14 mm broad and 8—15 times as long as broad. Flower buds, as described for *P. Junghuhniana*, were found in plants collected in all the parts of the Malay Archipelago. These buds are small and subglobose and to 2.5 mm long. The leaves of these plants agree, for the majority, with the descriptions of *P. neglecta* and *P. Junghuhniana*. They are usually 4—12 cm long by 8—16 mm broad, and 4.5—10 times as long as broad. The collections De Voogd 554 from Palembang, Teysmann 11359 from Karimata, and Merrill 1992 from Luzon, have much larger leaves with slightly acuminate apex, as often occur in younger plants. Which of these two bud shapes occurs in *P. neriifolia* from Nepal cannot be stated from the descriptions with certainty. Hooker (1888) gives the following diagnosis of the male flowers: "Male spikes 1 in., solitary or clustered, sessile, cylindric, surrounded at the base by broad acute keeled bracts". This points somewhat towards *P. bracteata*, which name is also given as a synonym. Hooker also gives *P. polystachya* as a synonym, but undoubtedly wrongly. In this species the flower buds are again entirely obtuse with usually obtuse bud scales. Therefore, and for the limited distribution, it seems to me more correct, to separate from *P. neriifolia* provisionally as a variety the plants with large, ovate, acute flower buds. A further examination, also of other parts of the plant, is still necessary. These deviations may be nothing but differences caused by climatological circumstances. Also in some of the new varieties the male flower buds deviate; those of the var. *atjehensis* and the var. *membranacea* mainly agree with those of *P. bracteata*, and those of the var. *Teysmannii* with those of the main form of the species, whereas the

buds of the var. *linearis* are more or less intermediate between these extremes. All the other collections, also those of which it was not possible to conclude from the leaf shape whether they belong to the var. *bracteata,* were included in the main form of the species. And the same was done with two collections, which deviate somewhat in the bud shape, *viz.* Boschpr. b.b. 11192 from Borneo with slightly spreading, short, acute bud scales, and Boschpr. Ja. 1873 from Japara with larger, ovate buds with obtuse scales.

For the rest this species is very variable in all its parts. As regards the bud scales, *e. g.,* this appears from the collection Soegandiredja 32 from G. Kentjana, of which the bud scales are sometimes 3 mm, sometimes up to 30 mm long, and from plants from Pangentjongan, among which Koorders 14025 has ovate-acute or very shortly acuminate, up to 4 mm long bud scales, Koorders 1255, on the contrary, very narrowly triangular, up to 18 mm long bud scales. In the sterile specimen Arsin 19594, from Tjibodas, the bud scales are very different on the same branch, varying from short-acuminate to long-subulate-acuminate, or very gradually narrowed, from 2 to 12 mm long. Very rarely the terminal bud is ovate or globose, and obtuse, whereas usually outer scales are mostly acute (Boschpr. b.b. 8740 from Benkoeloe has all the bud scales obtuse).

The proportion of length to width of the leaves varies strongly. As one extreme there occur the plants, described as *P. neglecta,* the leaves of which are 5—6 times as long as broad, and the originals of *P. discolor,* in which they are 3—8 times as long as broad. As the other extreme there occur some plants from Pangentjongan collected by Koorders, and Backer 12481 from Rantja Walini, the leaves of which are up to 15 times as long as broad, and the sterile specimen Houter 24 from Tjerebon, in which this amounts to even 15—20 times. The smallest leaves are those of Boschpr. b.b. 17030 from Sumatra, a mountain form of which the foliage wholly agrees with that of *P. discolor* (2.5—4.5 cm long and 5.5—8 mm broad), Von Römer 1230 from New Guinea (3—6.5 cm long by 5.5—8 mm broad) and Blume s. n. from Java (as *P. neglecta,* 3.5—5.5 cm long by 5—10 mm broad). The longest leaves have the specimens Teysmann 11359 from Karimata, Backer 12481 from Rantja Walini, Ridley 11192 from Johore and Houter 24 from Tjerebon, which are resp. up to 21, 19, 18 and 24 cm long. The leaves of Ridley 11192 from Johore, with a width of 28 mm, are the broadest of the species. Usually the leaves are very gradually narrowed towards the apex, but sometimes they are slightly

acuminate, especially in young plants; rarely are they abruptly short-acuminate into the apex (Teysmann 11359, from Karimata). The smaller, lanceolate leaves are often less gradually narrowed, but never abruptly narrowed as in *P. polystachya*. The midrib is rarely channelled on the lower surface, bud never so broadly as in *P. polystachya*; some of the leaves of the originals of *P. leptostachya* have a furrow instead of the midrib on the lower surface.

The number of vegetation periods that are leaf-bearing is usually 2 or 3, rarely 4 or 5 (*e. g.*, Rant 732, from Ambon, and von Römer 1230, from New Guinea). The leaves of these plants are, moreover, very small and adpressed to the twigs.

The fruit-bearing peduncles are rarely very short; when short peduncles are present, there occur also fruits with long peduncles on the same plants; otherwise than in *P. polystachya*, where all peduncles are short. The var. *brevipes* Blume, based on plants with very short peduncles and narrow, linear-lanceolate leaves, does not deserve to be distinguished, since there are too many transitions towards the main form of the species. In the collection Boschpr. b.b. 20061, from Schouten Island, there occur numerous, shortly peduncled female flowers, scattered over a great portion of the youngest vegetation period as in the var. *polyantha*, but no other deviations can be stated. In not a single specimen of the main form of the species were found receptacles with more than one fertile scale. In a specimen from Java (without exact locality and without collector) the base of one of the foliola was thickened and fleshy and was taken up in the receptacle.

Three specimens, included in *P. polystachya* by other authors, I consider as deviations of *P. neriifolia*. Forbes 2054 from Sumatra has rigid, rather shortly narrowed, lanceolate leaves, slightly folded upwards along the midrib; this reminds of *P. polystachya*, but the peduncles of the fruits are much longer than in this species. The sterile specimen Beccari P. S. 252 deviates strongly in its more abruptly narrowed, but flexible leaves, which are, however, not crowded and not erect-spreading. The specimen Winkler 3057 from Borneo has rigid, erect-spreading, but gradually narrowed leaves.

The specimens Brass 5907, included in *P. Rumphii* by Pilger, and Carr 12842, both from New Guinea, with rather long-lanceolate, rigid, rather shortly narrowed leaves, differ from *P. Rumphii* in the strongly prominent midrib above. Brass 5908, a youth-form of Brass 5907, is not different from other young plants of *P. neriifolia*.

MALAY PENINSULA. P. Penang: Government Hill, 700 m el., *Curtis* 3079

(S, f, m); Balik Pulau, *Ridley* 9422 (S, s); Perak: Thaiping Hills by the Waterfall up to 330 m el., *Wray, Künstler* (ex *Ridley* 1925 l. c.); Selangor: Bukit Hitam, *Kelsall* 2000 (S, f); G. Semangkok, *Sing.* Field No. 8877 coll. *Burkill* & *Holttum* (S, s); Negri Sembilan: G. Tampin, *Ridley* s. n. (S, s); Pahang: Cameron's Highlands, near Tanah Rata, *Sing.* Field No. 17745 coll. *Henderson* (B, s); Fraser Hill, 1300 m el., *Corner* s.n. (S, s); *For. Dep.* F. M. S. Field 22565 coll. *Deris* (S, m); Fraser Hill, upon the Selangor border, 1300—1400 m el., *For. Dep.* F. M. S. Field No. 7856 coll. *Burkill & Holttum*, v.n.: molukau (S, s); *Sing.* Field No. 11471 coll. *Md. Nur* (S, s); P. Tioman, G. Kajang, 1000—1100 m el., *Sing.* Field No. 18606 coll. *Md. Nur* (S, s); Malacca: Mt. Ophir, *Maingay* (ex *Ridley* 1925 l. c.); Johore: Banang, Batu Pahat, *Ridley* 11192 (S, s); S. Kayu, Mawai-Temalaang Rd., *Sing.* Field No. 32288 coll. *Corner* (S, f).

SIMEULOEE (Simaloer). Dist. Tapah (Dèfajan), *Achmad* 1388 (B, L, U, m); *Achmad* 1688, v.n.: naroe dotan (B, L, S, m).

MENTAWAI ISLANDS. P. Siberoet, Sebai-bai, Kosorai, 100 m el., *Boschpr.* b.b. 17444, v.n.: sirigdig (B, s).

SUMATRA. Without further locality, *Korthals* s. n. (G, L, f); Atjeh: subdiv. Gajo Loeeus, G. Agosan, 1800 m el., *Boschpr.* b.b. 22455, v.n.: beberas (B, m); Oostkust: S.W. of Bandarbaroe, 1100 m el., *Lörzing* 7264 (B, f); N.W. of Lake Toba, near Piso Piso, 1350—1500 m el., *Bangham* 1116 (S, s); subdiv. Karolanden, Pantjoerbatoe, res. Sibocatan, 1400 m el., *Boschpr.* b.b. 2784, v.n.: sitoboe hotang (B, L, f); near Pantjoerbatoe, E. foot of Mt. Sibocatan, 1400 m el., *Lörzing* 7118 (B, s); Tapiannoeli: Toba Plateau, Pansoerbatoe, 900 m el., *Boschpr.* b.b. 6203, v.n.: kajoe hotang (B, L, m); Westkust (W. coast): *Beccari* P. S. 252 (L, s); subdiv. Oud-Agam, S. Daheh, Batas Tjoeli, 1200 m el., *Boschpr.* S. W. K./II. 10, v.n.: madang soegi soegi (B, m); Bengkoeloe: subdiv. Lebong, Bt. Daoen, 2400 m el., shrub formation, *Boschpr.* b.b. 17030 (B, s); subdiv. Redjang, Karanganjar, 900 m el., *Boschpr.* b.b. 8823, v.n.: kajoe tadji (B, f); subdiv. Kroë, Wai mengaboe, 750 m el., *Boschpr.* b.b. 8740, v.n.: minangkas (B, L, m); G. Pesagi, 2300 m el., *Forbes* 2054 (L, f); 1400—2232 m el., *Van Steenis* 3690 (B, s); Palembang: Moeara-doea, Tenang, 500 m el., *De Voogd* 554 (B, m); G. Pakiwang, N. slope, 700 m el., *Van Steenis* 3756 (B, s); G. Semendo, 1400 m el., *De Voogd* 1494, v.n.: kajoe tadji (B, L, s); Lampoengsche Distr., div. Semangka, 750 m el., *Gusdorf* 314, v.n.: kajoe tadji koening (B, f).

KARIMATA ISLANDS. Soengei Tajan, *Teysmann* 11359 (B, L, m).

BORNEO. British North Borneo: Mt. Kinabalu, Gurulau spur, 1800 m el., *Clemens* 50691 (B, f); Penibukan ridge, 1200 m el., *Clemens* 50051 (BD, L, f); Sarawak: *Beccari* 2143 (ex *Pilger* 1903, l. c.); *Foxworthy* 444, 377 (ex *Merrill* 1921, l. c.); Western Part: G. Damoes, *Hallier* B. 559 (B, s); subdiv. Sekadau, Pait, 250 m el., *Boschpr.* b.b. 8054, v.n.: seloeang (B, f); Southern Part: without further locality, *Korthals* s. n., originals of *P. leptostachya Blume* (G, L, U, m); between S. Tarik and Kwaru, *Hub. Winkler* 3057 (B, L, m); Eastern Part: subdiv. Berouw, Telock Daoen, S. Kasei, 75 m el., *Boschpr.* b.b. 12196, v.n.: sensaniet (B, m); subdiv. Boeloengan, near river Binai, *Rutten* 3 (U, s); Mara, 300 m el., *Boschpr.* b.b. 10843 (B, s); Salimbatoe, S. Roemali, 150 m el., *Boschpr.* b.b. 11192, v.n.: lampega (B, m); subdiv. West-Koetai, Padang Loewai, 90 m el., *Posthumus* 2188, v.n.: endjan (B, s).

JAVA. Without further locality: coll.? (B, f); *Blume* s. n., v.n.: kimerak

(L, B, f); *Blume* s. n., originals of *Podocarpus discolor Blume* (G, L, U, s); *Korthals* s. n. (L, s); *Junghuhn* s. n. (B, s); *Koorders'* Plantae Junghuhnianae ineditae 55 (L, m); *De Vriese* s. n. (G, L, f); *De Vriese* 13 (L, m, f); *De Vriese & Teysmann* s. n. (L, f); "Sombosch", *Reinwardt* s. n. (L, f); "Patandji", *Junghuhn* s. n. (U, f); West-Java: G. Botol, near Nirmala, 1500—1800 m el., *Backer* 10749 (B, f); G. Wiroe, S.W. of Leuwiliang, 700 m el., *Bakhuizen van den Brink* 7792, v.n.: kipoetri (B, L, s); G. Salak, *Koorders* 24180, v.n.: kibeling (B, L, m); G. Salak, near Bodjong, 600—1000 m el., *Koorders* for. no. 1480*, herb. no. 24179, v.n.: kipoetri (B, L, W, f); G. Salak II, 2100 m el., *Van Steenis* 3018 (B, s); G. Salak, G. Soemboel, 1600—1900 m el., *Hoogerwerf* 5 (B, s); G. Salak and G. Telaga-ladang, 1700—2300 m el., *Zollinger* 2019 (U, f); Parakansalak, G. Poetri, near Perbakti, 1000 m el., *Koorders* 39401, v.n.: kipoetri (B, f); Parakansalak, G. Poetri, Tjikramat, *Koorders* 39405 (B, s); Buitenzorg, estate Tjiomas, cultivated, *Backer* 37539 (Pa, s); Poentjak Gedeh, above P. Harendong, 1500 m el., *Van Slooten* 748 (B, s); Megamendoeng, *Zippelius* s. n. (L, s); G. Gedé, native coll. s. n. (B, f); G. Gedé, Tjiparaj, 1200 m el., *Uhl* 6617 (B, m); *Uhl* 6592, v.n.: kipoetri (B, f); Tjibodas, *Arsin* 19594 (B, L, s); *Scheffer* s. n. (B, L, s); *Koorders* for. no. 3031a, herb. no. 1243 (B, L, s), 1244 (B, s), 12627 (B, s), 41778 (B, s); for. no. 3362a, herb. no. 41992, v.n.: kibima (B, s); Tjipadaroeoem, 1850 m el., *Boschpr.* Ja. 1948, v.n.: kipoetri (B, f); 1750 m el., *Boschpr.* Ja. 3988, v.n.: kipoetri (B, s); G. Boerangrang (G. Soenda), *Blume* s. n. (L, f); 1850 m el., *Van Slooten* 471 (B, s); *Bakhuizen van den Brink* 4586 (B, L, f); Bandoeng, *Junghuhn* s. n., v.n.: kipoetri (L, f); Tjinjiroean near Bandoeng, *Docters van Leeuwen-Reijnvaan* s. n. (B, s); Nanggerang (div. Tasikmalaja), 2120 m el., *Boschpr.* Ja. 1356 (B, s); Tjigenteng, Kawah Tjiwidej Reserve, 1425 m el., *Boschpr.* Ja. 1311, v.n.: kipoetri (B, s); Tjigenteng, *Koorders* 1249, v.n.: kipoetri (B, s); *Koorders* 1259 (B, f); *Koorders* for. no. 1439*, herb. no. 33751, v.n.: kipoetri (B, f); for. no. 2195a, herb. no. 1240, v.n.: kibima (B, L, f), 1260 (B, f), 11720 (B, L, f); Tjigoeloedoeg, 1050 m el., *Boschpr.* Ja. 1505, v.n.: kipoetri (B, s); Sanggrawa distr., Djampang koelon, 400 m el., *Koorders* 1252, v.n.: kisèèl (B, s); Tjibeber, *Hasskarl* 377, v.n.: kipoetri aweweh (L, s); G. Masigit, 1650 m el., *Backer* 12407, v.n.: kipoetri (B, s); G. Patoeha, *Blume* s. n. (L, m); G. Patoeha, Telaga Patengan, *Warburg* 2679 (ex *Warburg* 1900, l. c.); Rantja Walini, 1750 m el., *Backer* 12481 (B, f); G. Tiloe, Pengalengan, *Warburg* 11118 (ex *Warburg* 1900, l. c.); Pengalengan, *Junghuhn* s. n. (U, f); 1400 m el., *Junghuhn* s. n., v.n.: merak (L, m); G. Malabar, *Van der Pijl* 229 (B, L, s); G. Kantjena, *Soegandiredja* 32 (B, f); G. Kendang, 1800 m el., *Koens* 183 (B, s); G. Kendeng, near Tjiwidej, *Koorders* 1251, v.n.: kibima (B, s); G. Monteng, *Scheffer* s. n., v.n.: kimerak (B, s); Rioeng Goenoeng, *Scheffer* s. n. (B, f); near Kawak Manoek, *Scheffer* s. n. (B, s); Tjilaki, 1500 m el., *Forbes* 924 (L, f); G. Papandajan, and G. Saroni and ravine of the Tji Paroegpoeg, 2100—2600 m el., *Van Steenis* 4127, v.n.: kipoetri (B, L, s); Telaga-Bodas, *Blume* s. n. (L, s); *Burck* 144, v. n.: kipoetri (B, f); G. Telaga-Bodas, Padjagalang, *Reinwardt* s. n., v.n.: kimarak (L, s); Pangentjongan, G. Telaga-Bodas, *Koorders* 1256, v.n.: kibima (B, L, s); for. no. 2430aa, herb. no. 13847 (B, L, s); 14025, v.n.: kipantjar (B, f); Pangentjongan, N.W. of G. Gloengoeng, 1600 m el., *Koorders* 1215, v.n.: kipantjar (B, f); 1254, v.n.: kipoetri (B, L, s); 1253, v.n.: kipantjar (B, L, f); 1255 (B, L, f); 1800 m el., *Koorders* 1258, v.n.: kipantjar (B, f); Pangentjongan, forest Pasir Ipis, 1400—1500 m el., *Koorders* 13892, v.n.: kipantjar (B, L, f); 14066 (B, L, f); 14200, v.n.: kipantjar, kibima (B, L, f);

for. no. 2438a, herb. no. 13997 (B, L, m); for. no. 2500aa, herb. no. 26560, v.n.: kibima (B, f); Pangentjongan, forest Pasir Tjitjalengka, 1500 m el., *Koorders* 14144, v.n.: kipantjar (B, L, f); 1400 m el., *Koorders* 14206, v.n.: kipantjar, kibima (B, L, f); Pangentjongan, forest Pasir Kajoejoetan, *Koorders* for. no. 579*, herb. no. 26553, v.n.: kibima (B, f); Noesagedé, in the Pendjaloe Lake, 700 m el., *Koorders*, herb. no. 44323 (B, s); Tjerebon, Koeningan, *Houter* 24, 25 and 178, v.n.: kibima, kitadji (B, s); Central-Java: G. Slamet, forest Bentjana, 1360 m el., *Koorders* 1229 (B, f); Dièng, G. Prahoe, *Junghuhn* s. n., v.n.: melella (L, s); Dièng, Telaga-tezi, *Junghuhn* s. n., v.n.: melella (L, s); N.W. of G. Prahoe, above Soerdjo, 1800 m el., *Koorders* 11248, v.n.: melela (B, s); G. Oengaran, *Junghuhn* s. n., v.n.: marangang (B, L, U, m); *Koorders* for. no. 2420i, herb. no. 1223, v.n.: mlelo (B, L, s); G. Oengaran, Telemojo, 1300 m el., *Koorders* for. no. 1443*, herb. no. 35781 (B, s), 1400 m el., for. no. 2078*, herb. no. 35935, v.n.: maron (B, s); for. no. 2305*, herb. no. 1222, v.n.: kajoe piting (B, L, s); reg. Japara, Soemanding, 800 m el., *Boschpr.* Ja. 1873, v.n.: antoh (B, L, m); East-Java: G. Ardjoeno, Soember Brantas, 1650 m el., *Boschpr.* Ja. 1747, v.n.: tjemoro belah (B, s); G. Tengger, Tosari, forest Sekar koenig, 1600 m el., *Koorders* for. no. 1933*, herb. no. 37925, v.n.: woeloean (B, s); Zuidergebergte, forest Soember Tangkil, 600 m el., *Koorders* for. no. 382*, herb. no. 23733 (B, L, s); G. Ijang, between Bremi and Tama Hidoep, *Van Dillewijn* 183 (Pa, s); G. Ijang, Towan Idoep Lake, 1960 m el., *Altmann* 362 (B, s).

LESSER SUNDA ISLANDS. Bali: Peak of Tabanan, 1600 m el., *De Voogd* 1844, v.n.: soa (B, f).

PHILIPPINES. Luzon: Benguet prov., *For. Bur.* 10894 coll. *Curran* (L, f); Tayabas prov., Pagbalao, *Merrill* 1992 (S, m); Abra prov.; Polillo; Mindoro; Sibuyan; Mindanao; Jolo (all ex *Merrill* 1923, l. c.).

CELEBES. Minahassa, bivouac Pinimorangan near Kajoewatoe, 500 m el., *Koorders* for. no. 1545*, herb. no. 16533, v.n.: marama-rendaj (B, L, f); Tondano, 725 m el., coll. W., s. n. (W, f); subdiv. Donggala, Rarampondo, 1500 m el., *Boschpr.* b.b. 15085, v.n.: marisa, k. (B, L, f); subdiv. Malili, near La Roua, *Boschpr.* b.b. 2414 (B, s); N. Rumbia, Lasuruma River and Mt. Ossu-sohua, 250—755 m el., *Elbert* 3129 (L, s).

MOLUCCAS. Batjan: without coll., v.n.: lewi kajoeang (B, m); G. Sibéla, 1600—2000 m el., *Roepke* 4 (B, s); *Warburg* 18245 and 18284 (ex *Pilger* 1903, l. c.; see also *P. Rumphii*); Masoeroeng, 500 m el., *Boschpr.* b.b. 23143, v.n.: kajoe ratja oetan (B, s); Ambon: G. Salhoetoe, 1030 m el., *Rant* 732 (B, s); Tanimber Islands: Otimmer, 100 m el., *Boschpr.* b.b. 24379, v.n.: kadje sanoedoene (B, s).

JAPEN ISLANDS. Schouten Island, Soperi, Opiaref, 25 m el., *Boschpr.* b.b. 15914, v.n.: nasbraren, kajoe tjina (B, s); Aipiaimi, Papoema, along the seashore, 0 m el., *Boschpr.* b.b. 20061, v.n.: topangkei (B, m).

NEW GUINEA. N.W. Part: subdiv. West-New Guinea, Kali Kamoendang, 3 m el., *Boschpr.* b.b. 21933, v.n.: kajoe tjina, obereha (B, m); Taniba, *Boschpr.* b.b. 22498, v.n.: ai sina (B, m); Hellwig Mts, summit Mt. Agathodaemon, 2577 m el., *Von Römer* 1230 (B, s); N.E. Part: Zuckerhut, *Ledermann* 7105 (BD, s); Kani Mts., 1000 m el., *Schlechter* 16790 (BD, s); Mt. Gelu, 1700 m el., *Werner* 159 (ex *Pilger* 1916, l. c.); near Passai, *Hellwig* 651 (BD, s); Passai, Sattelberg, *Warburg* 21127 (BD, s); Morobe distr., Sattelberg, 800—1000 m el., *Clemens* 2276 (BD, f); Ogeramnang, 1850 m el., *Clemens* 5434 (BD, f); Ogeramnang to Tobou, 1650—

2000 m el., *Clemens* 6578 (BD, f); Morobe distr., Wareo, 700 m el., *Clemens* 1481 (BD, L, s); S.E. Part: *Okney* s.n. (ex *Koorders* 1914, l.c.); Owen Stanley Range, *Lane-Poole* 238, 275 (ex *Lane-Poole* 1925, l.c.); Koitaki, 500 m el., *Carr* 12842 (BD, L, f); Isuarava, 1600 m el., *Carr* 15395 (BD, m); Western Division, Wuroi, Oriomo River, 10—20 m el., *Brass* 5907 (B, BD, f); *Brass* 5908 (B, BD, s); Central Division, Wharton Range, Murray Pass, 2840 m el., *Brass* 4605 (B, BD, f).

SOLOMON ISLANDS. Malaita Island: interior from Quoimonapu, 300 m el., *Kajewski* 2370, v.n.: dingali (B, f, m).

Cultivated: in Hort. Bot. Buitenzorg, sub no. V. F. 3 (B, s); V. F. 21 (B, s); V. F. 33, 33a, from Java (B, s); V. F. 35, from Java (B, m); V. F. 45, from S. New Guinea (B, s); V.F. 67, 67a, 75a, 78, from Java (B, s); 8 [XII. B. (VI)], (B, s).

Further distribution: Eastern Himalaya, Khasia, Burma, Andaman Islands (ex *Hooker* 1888, l.c.); French Indo-China, from Tonkin to Cochin-China (ex *Hickel* 1931, l. c.); China from Yunnan to Kiangsu (ex *H. H. Hu* 1934, l. c.); Hongkong (ex *Dunn & Tutcher* 1912, l. c.); Formosa (ex *Hayata* 1911, l. c.); Fiji Islands (ex *Gibbs* 1909, l. c.).

P. neriifolia var. β **bracteata** (Blume) Wasscher, n. comb. — *Podocarpus bracteata* Blume, Enum. Pl. Javan., 1 (1827) 88; (see for the other literature under the species).

Terminal buds narrow-conical, acute; bud scales usually long, very gradually narrowed, usually erect, acute. Leaves spreading, linear-lanceolate or lanceolate, rather gradually narrowed towards the base, very gradually attenuate into the acute apex, 10—17 cm long by 9—14 mm broad, 8—15 times as long as broad; midrib on the upper surface distinct, narrowly prominent, sharply delimited, sometimes even by means of a furrow on each side. Male flower buds single or to 3 in the leaf axils, sessile, large, to 8 mm long and 4 mm broad, ovate-acute; bud scales often somewhat spreading, ovate-triangular, acute, the outer ones keeled. (Description from the specimens mentioned below).

This variety differs from the main form of the species in the large, ovate-acute, male flower buds, with squarrose, ovate-triangular, acute bud scales. See also the discussion after the description of the species. To this variety probably also belong some plants with entirely developed flowers and of which the buds, as a consequence, are too old to be judged about. The flowers of these plants are long-cylindrical or filiformous, 2.5—8.5 cm (according to Blume 1847, l. c., up to 10 cm) long, and 2.5—3.5 mm in diam.; the lower portion of the axis of the flower is usually strongly elongate, thus forming a 5—10 mm long portion with remote, usually membranous scales only.

JAVA. Without exact locality, *Blume* s. n. (L, m); *Perottet* s. n. (L, m); G. Megamendoeng, *Blume* s. n. (L, m); G. Boerangrang, *Blume* s. n. (L, m); G. Kendeng,

Scheffer s. n., v.n.: kipoetri (B, m); G. Goentoer, 1600 m el., *Danser* 6792 (B, m); G. Ardjoeno, 1800 m el., *Koorders* for. no. 1929*, herb. no. 38198 (B, L, m).

Perhaps also (with developed flowers):

JAVA. Without exact locality, *Hasskarl* s. n. (L, m); G. Megamendoeng, *Blume* s. n. (L, m); Tjigenteng, *Koorders* 1250, v.n.: kipoetri (B, m); Pangentjongan, *Koorders* for. no. 295*, herb. no. 26540, v.n.: kibima (B, m).

P. neriifolia var. γ **membranacea** Wasscher, n. var.

Gemma terminalis magna, ovata vel ovato-conica, ad 15 mm longa, perulis plerumque anguste ovatis, ad 13 mm longis, omnino membranaceis. Folia lanceolata, 6—10 cm longa, 7—10 mm lata, 7—10 $\times$ longiora quam lata. Alabastra mascula singula in axillis, ovata vel ovato-conica, acuta, ad 7 mm longa, perulis ut gemmae terminalis.

Terminal buds large, ovate or ovate-conical, to 15 mm long and 7 mm broad; the outer bud scales triangular, stout, shortly acuminate, keeled, to 3 mm long, the inner ones narrowly ovate, obtuse, entirely membranous, to 13 mm long. Leaves more or less spreading, rather thick-coriaceous, rigid, lanceolate, gradually narrowed towards the base and the apex, 6—10 cm long by 7—10 mm broad, 7—10 times as long as broad; midrib distinct, narrowly prominent above. Male flower buds single in the leaf axils, ovate or ovate-conical, acute, to 7 mm long; bud scales wholly membranous as in the terminal buds. (Description from both collections mentioned below).

This variety differs from the main form of the species by the membranous scales of the terminal buds and the ovate-acute male flower buds.

CELEBES. Upper-Binoeang, estate Tamalanti, *Boschpr.* b.b. 20204 (B, s); Masamba, estate Peororoa, 1300 m el., *Boschpr.* b.b. 24158 (B, m), type of the variety.

P. neriifolia var. δ **atjehensis** Wasscher, n. var.

Gemma terminalis plerumque magna, perulis exterioribus sensim angustatis vel in acumen subulatum productis, saepe omnino reflexis, ad 20 mm longis, interioribus adjacentibus, acutis. Folia maxima parte reflexa, angustissime lanceolata, 7—18 cm longa, 5—8.5 mm lata, 10—20 $\times$ (plerumque 13—16 $\times$) longiora quam lata. Alabastra mascula singula in axillis, acute ovata, perulis acutis, ad 5 mm longis. Flores masculi 2—3 mm longi, 4—4.5 mm in diametro.

Terminal buds large, sometimes nearly globose, sometimes narrower; the outer bud scales sometimes deflexed, narrow-triangular, very gradually narrowed or subulate-acuminate from an ovate base, up to 20 mm long, the inner ones more ovate-triangular, acute or very shortly acuminate, adpressed, sometimes with the apex curved outwards, often with narrow membranous margin. Leaves rather crowded, deflexed for

the greater portion, sometimes partly more or less spreading on the youngest vegetation period, rather thick-coriaceous, rigid, very narrowly lanceolate, very gradually narrowed towards the base and the acute, sometimes mucronate-acute apex, 7—18 cm long by 5—8.5 mm broad, 10—20 (usually 13—16) times as long as broad; midrib strongly prominent, narrow, sharply delimited above. Male flower buds single in the leaf axils, sessile, rather large, ovate-acute; bud scales acute, often subulate-acuminate, up to 5 mm long, the inner ones more ovate-obtuse; male flowers rather thick-cylindrical, 2—3 cm long and 4—4.5 mm in diam. Female flowers solitary in the leaf axils on slender peduncles. Peduncles 8—16 mm long, flattened and broadened towards the apex; foliola large, 3.5—6 mm long; receptacle subcylindrical or narrowly obconical, 7—9 mm long by 3—4 mm broad; seed subelliptical, obtuse, 9—10 mm long by 7—8 mm broad. (Description from both collections mentioned below).

According to Van Steenis' herbarium labels this variety is a characteristic small tree, about 5 m tall, the young foliage of which is beautifully pink. It yields a white, glutinous resin. The fruit is white- or bluish-pruinose. This variety occurs in mossy forests and shrub formations at the higher elevations. It differs from the main form of the species in its deflexed, very narrowly lanceolate leaves, the larger terminal buds with partly deflexed scales, the larger, ovate-acute male flower buds with subulate-acuminate outer scales and the thicker male flowers.

SUMATRA. Atjeh: Gajolanden, G. Leuser, 2250—2750 m el., *Van Steenis* 8470 (B, f); G. Kemiri, 2900—3314 m el., *Van Steenis* 9614 (B, f, m), type of the variety.

P. neriifolia var. ε **timorensis** Wasscher, n. var. — *Podocarpus polystachya* (non R. Brown 1838) De Voogd, in Trop. Nat., 27 (1938) 63.

Folia approximata, divergentia vel erecta, crassiuscule coriacea, breviter lanceolata, subabrupte in acumen acutum, nonnunquam pungens, attenuata, 3.5—6.5 cm longa, 8—11 mm lata, 4—6 × longiora quam lata, costa facie superiore nonnunquam linea elevata angusta, plerumque plana vel leviter impressa. Flores masculi 1—3 in axillis, 2—2.5 cm longa, 4 mm diametro.

Terminal buds acute; bud scales from an ovate-triangular base long-subulate-acuminate, strongly keeled, to 7 mm long. Leaves rather crowded, spreading or erect-spreading, rather thick-coriaceous, rigid, rather short-acuminate, gradually or cuneately narrowed into the very short petiole, rather shortly narrowed into the acute apex, sometimes with an apiculus to 2 mm long, 3.5—6.5 cm long by 8—11 mm broad,

4—6 times as long as broad; midrib on the upper surface usually flat or even slightly impressed, sometimes prominent as a narrow line, on the lower surface broader, keeled towards the base; lamina with slightly thickened and very shining margins. Male flowers 1—3 in the upper leaf axils, crowded just below the terminal bud, sessile, cylindrical, 2—2.5 cm long and 4 mm in diam., at the base with some sterile, ovate-triangular, acute or rather obtuse, keeled bracts, with narrow membranous margin; stamens with short, ovate-triangular, rather obtuse apiculus. Female flowers and fruits unknown. (Description from the type specimen.)

This variety differs from the main form of the species in the indistinct, not or hardly prominent midrib, and the leaves shorter-narrowed towards the apex and often with a mucro, whereas the male flowers are thicker. The collection mentioned below is taken from a 15 m tall tree with drooping branches.

TIMOR. G. Moetis, 2000 m el., *De Voogd* 2301, common between 1500 and 2000 m el. (B, m), type of the variety.

P. neriifolia var. ζ **linearis** Wasscher, n. var.

Gemma terminalis ovata, perulis plerumque ovatis, obtusis vel late truncatis, 3—4 mm longis, 2.5—3 mm latis. Folia lineari-lanceolatis, marginibus parallelis, 10—18 cm longis, 7—12 (raro ad 16) mm latis, 10—20 × longiora quam lata, costa supra angusta vel linea angusta prominente. Alabastra mascula singula in axillis, magna, ovata, obtusa, 4—6 mm longa, 3—4 mm lata, perulis plerumque ovatis, obtusis.

Terminal buds ovate, obtuse; bud scales ovate, obtuse or broadly truncate at the apex, 3—4 mm long by 2.5—3 mm broad, the outer ones sometimes more acute or very shortly acuminate, keeled and sometimes with broad membranous margin. Leaves spreading, linear-lanceolate, with the margins parallel over a great part of the length, usually gradually narrowed towards the base, rather shortly or gradually narrowed towards the apex, 10—18 cm long by 7—12 (rarely to 16) mm broad, 10—20 times as long as broad; midrib narrow, prominent as a narrow line above. Male flower buds single in the leaf axils, large, ovate, obtuse, 4—6 mm long by 3—4 mm broad; bud scales ovate, the outer ones shorter and ovate-triangular and strongly keeled, the inner ones with membranous margin. Male and female flowers and fruits unknown. (Description from the specimens mentioned below).

This variety differs from the main form of the species in the narrower leaves with the margins parallel, the obtuse terminal buds and the large, ovate, male flower buds.

JAVA. G. Gedé, native collector 337, v.n.: kipoetri (B, s), type of the variety; Djember, Tjoeramanis Simpolan, *Koorders* for. no. 4185w, herb. no. 1236 (B, L, s), 21091 (B, L, m), and 38501 (B, s), v.n.: bangkol; *Koorders* 1237 (B, L, s).

Cultivated: in Hort. Bot. Buitenzorg, v.n.: kibima (B, s).

P. neriifolia var. η **Ridleyi** Wasscher, n. var.

Folia crassa coriacea, lanceolata, sensim ab infra medium ad apicem acutum angustata, 5—12 cm longa, 6—12 mm lata, 7—13 × longiora quam lata, costa supra paulum distincta, plana vel leviter impressa, nonnunquam linea angusta prominente, infra prominente, saepe leviter sulcata. Alabastra mascula plerumque terna in axillis, ovata, obtusa, parva. Pedunculus fructifer brevissimus, 1—3 mm longus.

Terminal buds ovate-acute or conical; bud scales ovate-triangular, subulate-acuminate, keeled, to 13 mm long. Leaves spreading, thick-coriaceous, straight or slightly falcate, lanceolate, rather gradually narrowed into the short petiole, very gradually narrowed from below the middle to the acute apex, 5—12 (rarely to 14) cm long by 6—12 (rarely to 14) mm broad, 7—13 times as long as broad; midrib on the upper surface not very distinct, flat or even slightly impressed, sometimes prominent as a narrow line, on the lower surface distinct, broader, keeled, often shallow channelled. Male flower buds usually in bundles of 3, sessile, ovate, small, obtuse; bud scales ovate, obtuse, the outer ones more acute and keeled, 2 mm long; male flowers cylindrical, to 2.5 mm long. Female flowers single in the leaf axils. Peduncles very short, 1—3 mm long, spreading; foliola subulate, to 2.5 mm long; receptacle short-cylindrical, 5 mm long and 3 mm broad; young fruit ovate-elliptical, obtuse. (Description from the specimens from the Malay Peninsula).

According to Holttum this variety is one of the commonest trees on G. Blumut, striking in its yellow-green leaves. It differs from the main form of the species in its thicker leaves which are still more gradually narrowed into the apex, the usually impressed or not prominent midrib and the very short peduncles of the fruit. From *P. Rumphii* it may easily be distinguished by the long-narrowed leaves.

MALAY PENINSULA. Malacca: Mt. Ophir, 650—1000 m el., *Ridley* 3158 (S, f); *Ridley* 10016, type of the variety (S, m); Johore: G. Blumut, 1000 m el., *Sing.* Field no. 10720 coll. *Holttum* (S, B, f).

Perhaps also:

BORNEO. Western Part: G. Semedoem, *Hallier,* B. 720 (B, L, S, U, m).

P. neriifolia var. ϑ **Teysmannii** (Miquel) Wasscher, n. comb. — *Podocarpus Teysmannii* Miquel, Fl. Ind. Bat., II, 6 (1859) 1072; suppl. Sum. (1860) 252, 589; De Boer, Conif. Arch. Ind. (1866) 14, 28, 36,

37, t. 1; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 516; Gordon, Pinetum, ed. 2 (1875) 348; Filet, Plantk. Woordenb. (1876) 278; Warburg, Monsunia, 1 (1900) 193; Pilger, in Engl., Pflanzenr., IV, 5 (1903) 81; Merrill, Bibl. enum. Born. pl. (1921) 31; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 280, 283. — *Nageia Teysmannii* Kuntze, Rev. Gen. Plant., 2 (1891) 800.

Terminal buds globose; the outer bud scales thick, ovate-triangular or nearly orbicular, slightly acute or sometimes subobtuse, up to 3 mm long, rarely thick-subulately narrowed, up to 5 mm long, the inner ones ovate, obtuse, with membranous margin. Leaves rather remote, somewhat crowded towards the apices of the vegetation periods, usually spreading, rather thick-coriaceous, broad-lanceolate, the margins often parallel, gradually or sometimes cuneately narrowed into the distinct, broad petiole, usually rather abruptly narrowed and shortly acuminate into the acute or sometimes slightly rounded apex, 8.5—17 cm long by 16—26 mm broad, 5—9 times as long as broad; midrib on the upper surface thick- and rather broadly prominent, slightly rounded and sharply delimited, on the lower surface broad, keeled towards the base, rather flat and sometimes slightly channelled towards the apex. Male flower buds single in the leaf axils, globose or ovate-globose, to 3 mm long; bud scales subovate, sometimes ovate-triangular, obtuse, with membranous margin. Male and female flowers and fruits unknown. (Description from the type specimens).

This variety differs from the main form of the species in the globose, obtuse, terminal buds, the broad-lanceolate, shortly acuminate leaves and the large male flower buds. The type specimens are remarkably different from *P. neriifolia*, but the other collections show, in some respects, an approach towards the main form. The plant from Bangka, *e. g.*, has leaves, of which the older ones agree with those of the type specimens, whereas some of the youngest leaves are not different from those of *P. neriifolia*. The scales of the terminal buds of the plant from Lingga are rather acute and the leaves are thinner, whereas of the collection Boschpr. b.b. 4001 the buds are globose, and the leaves are much less typical as in the plants from Sibolga. Therefore, *P. Teysmannii* may be at best a variety of *P. neriifolia*.

SUMATRA. Tapiannoeli: Sibolga, sea shore, *Teysmann* 513 H. B., v.n.: sikoejoe laut (B, L, U, m), originals of *P. Teysmannii Miq.*; *Zollinger* 1646 (ex *Pilger* 1903, l. c.); Westkust (W. coast): subdiv. Painan, Br. Belanti, 425 m el., *Boschpr.* b.b. 4001, v.n.: kalek rotan (B, L, m).

LINGGA ARCHIPELAGO. P. Lingga, G. Tanda, *Teysmann* s. n. (B, L, s).

BANGKA. Soengeiliat, G. Boei, *Teysmann* s. n., v.n.: kajoe sembilang (B, G, s).
BORNEO. Sarawak: Beccari (ex *Parlatore* l. c.).

P. neriifolia var. ι **polyantha** Wasscher, n. var.

Folia lanceolata vel late lanceolata, marginibus saepe parallelis, apicem versus abrupte vel magis sensim attenuata, saepe breviter acuminata, 6—16 cm longa, 13—20 mm lata, 4.5—8 × longiora quam lata, facie inferiore saepe sulca loco costae. Flores feminei numerosi secus ramulos proximi anni; receptaculum e squamis 2—4 carnosis compositum; ovulum singulum, vel 2. Pedunculus fructifer brevissimus, 1.5—5 mm longus.

Terminal buds conical, acute; bud scales from an ovate base usually abruptly contracted into a long acumen, up to 5 mm long, rarely gradually narrowed and to 12 mm long. Leaves spreading, more or less coriaceous, straight or slightly falcate, lanceolate, or broad-lanceolate, the margins usually parallel, short-cuneately or rather gradually narrowed into the short petiole, often abruptly and shortly acuminate into the acute apex, 6—16 cm long by 13—20 mm broad, 4.5—8 times as long as broad; midrib on the upper surface prominent, narrow and sharp, almost keeled, often indistinct near the apex, on the lower surface usually with a narrow and deep furrow (in the leaves of young plants sometimes broader prominent, flat). Male flowers unknown. Female flowers numerous, all over the youngest vegetation periods, in the axils of bracts as well as in those of the leaves and above the leaf scars; the few bracts sessile with broad base, acute, to 1.5 cm long by 2.5 mm broad; peduncles short, spreading; foliola subulate, to 3 mm long; receptacle composed of 2—4 fleshy scales, of which 1—2 fertile, often somewhat curved. Peduncles thick, 1.5—5 mm long; receptacle short- and thick-cylindrical, 6—7 mm long and 4—5 mm broad; seed elliptical-ovate, 10 mm long and 6 mm in diam. (Description from the specimens mentioned below.) Cfr. *Plate V 17 ι*.

According to herbarium labels, this variety is a tree up to 40 m tall, with slender, straight bole. The crown is attached to the bole rather high, and is small, very strongly branched and very dense (Grashoff 1030), rounded ovate, very large and dense, with remarkably light-green foliage (Van Steenis 3179). The female flowers are fragant and have a rather sharp taste (Boschpr. 192T. 3P. 567). To this collection belongs also a seedling with root nodules.

The var. *polyantha* differs from the main form of the species in the larger number of female flowers, which often bear 2 ovules, in the usually shorter and more abruptly narrowed and shortly acuminate

leaves, often with a furrow on the lower surface; moreover, these plants are the only ones, which have bracts below the female flowers.

SUMATRA. Palembang: div. Rawas, 100 m el., *Grashoff* 1030, v.n.: kajoe tjina (B, L, s); subdiv. Lematang Ilir, ds. G. Megang, 75 m el., *Boschpr.* 192T. 3P. 567, v.n.: kajoe tadji (B, L, W, f), type of the variety; near Banding-agoeng along the road to Simpang, N. of the Ranau Lake, 600 m el., *Van Steenis* 3179 (B, L, U, W, f).

18. **Podocarpus Ledermannii** Pilger, in Bot. Jahrb., 54, 3 (1916) 210; in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 248; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 279, 283.

Twigs solitary or subopposite, spreading, rather slender. Terminal buds narrowly ovate-conical, acute; bud scales narrowly triangular or lanceolate-subulate, very acute, to 6 mm long. Leaves scattered, usually rather remote, more crowded below the terminal buds, somewhat coriaceous and rigid, oblong-lanceolate or narrowly oblong, usually shortly subcaudate-acuminate into the acute apex, short-cuneate or rounded-cuneate at the base, with the petiole distinct and 3—5 mm long, 3.5—5 times as long as broad, 6—12 cm long by 17—28 mm broad; midrib narrow, strongly prominent and sharply delimited above, keeled towards the base and more flat towards the apex beneath; lamina with flat or slightly recurved margins, shining above, dull beneath. Male flower buds 2—3 on very short, 0.5—1.5 mm long common peduncles, small, ovate-acute; bud scales ovate-triangular, acute or shortly acuminate, keeled, to 2 mm long, with membranous margin, the inner ones somewhat obtuse; male flowers cylindrical; stamens with ovate-triangular, rather obtuse to acute apiculus. Female flowers and fruits unknown. (Description from Ledermann's specimens). Cfr. *Fig. 4.*

According to herbarium labels, *P. Ledermannii* is a tree 5—20 m tall, with greyish to brownish bark and open, thin crown; the not completely ripe male flowers are white or pale yellow. The tree occurs in light mountain forests.

This species is most closely allied to *P. neriifolia*, perhaps it represents only a form of this polymorphic species. It differs in the more oblong leaves with somewhat caudate-acuminate apex. From *P. Rumphii* it differs moreover in the strongly prominent midrib and the male flowers usually placed in bundles of 3.

NEW GUINEA. N.E. Part: Kaiserin-Augusta-Fluss-Expedition, Lordberg, 1000 m el., *Ledermann* 9878, 9943, 9996 (all BD, m), and 10064a (BD, s), originals of the species.

19. **Podocarpus polystachya** R. Brown. — *Podocarpus neriifolia* [1]) D. Don, in Lambert, Genus Pinus, ed. 1 (1824) 21 p.p.; [1]) ed. 2

(1828) II, 122, p.p.; Hooker f., Fl. Brit. Ind., 5, 3 (1888) 649 p.p. — *Podocarpus polystachya* R. Brown, ex Mirbach, in Mém. Mus. hist. nat., 13 (1825) 47, 54, nomen; Bennett, in Horsfield, Pl. Jav. rar. (1838) 40, nomen; Endlicher, Syn. Conif. (1847) 215; Miquel, Fl. Ind. Bat., II, 6 (1859) 1072; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 392; Carrière, Traité gén. Conif., ed. 2, II (1867) 662; De Kirwan, Conif. 2 (1868) 228; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 515; Gordon, Pinetum, ed. 2 (1875) 345; Filet, Plantk. Woordenb. (1876) 182; Warburg, Monsunia, 1 (1900) 192; [2]) Pilger, in Engl., Pflanzenr., IV, 5 (1903) 79; Merrill, in Philipp. Journ. Sci., 3 (1908) 394; [2]) Ridley, in Journ. Str. Br. Roy. As. Soc., 60 (1911) 58; [2]) Foxworthy, in Philipp. Journ. Sci., 6 (1911) 161; Gibbs, in Ann. Bot., 26 (1912) 546, t. 50, ic. 35—37, t. 51, ic. 38—43; [2]) Stiles, in Ann. Bot., 26 (1912) 455, 459; [2]) Gibbs, in Journ. Linn. Soc., 42 (1914) 13; [2]) Stapf, in Journ. Linn. Soc., 42 (1914) 194; [2]) Pilger, in Bot. Jahrb., 54, 1 (1916) 38; [2]) Merrill, Bibl. enum. Born. pl. (1921) 31; Enum. Philipp. Flow. Pl., 1 (1923) 4; [2]) Ridley, Fl. Mal. Pen., 5 (1925) 282, ic. 228; Lam, in Hand. IV Ned. Ind. Natuurwet. Congr. (1926) 393; [2]) Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 247; Dakkus, in Bull. Jard. Bot. Buitenz., sér. 3, suppl. vol. 1 (1930) 237; [2]) Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 280, 283; [2]) Van Steenis, in Bull. Jard. Bot. Buitenz., sér. 3, XII, 2 (1932) 185; Polak, in Verh. Kon. Akad. Wet. Amst., 30, 3 (1933) t. L, ic. 24; Merrill, in Proc. Fifth Pac. Congr. Can., 4 (1934) 3269; [2]) Burkill, Dict. Econ. Prod. Mal. Pen., 2 (1935) 1779; Wasscher, in Backer, Bekn. Fl. Java, 2 (1940) fam. 18, 3. — *Podocarpus littoralis* Teysmann, in Nat. Tijdschr. Ned. Ind., 36 (1876) 237; Wigman, in Teysmannia, 15 (1904) 9. — *Nageia polystachya* Kuntze, Rev. Gen. Plant., 2 (1891) 800. — *Podocarpus neglecta* (non Blume) Ridley, in Agric. Bull. Str. and F. M. S., 1 (1902) 289; 5 (1906) 251; in Bull. Kol. Mus. Haarlem, 27 (1903) 105.

[1]) *P. nereifolia.* [2]) *P. polystachyus.*

Twigs to 5 subverticillate, usually straight, spreading under wide angle, terete. Terminal buds ovate, acute, sometimes narrowly conical; bud scales either from an ovate base rigidly subulate-acuminate, sometimes with reflexed apex, or very long and gradually narrowed and erect, usually 2½—4 mm, rarely up to 10 mm long, keeled. Leaves scattered, usually strongly crowded at the apex of the branchlets, erect or erect-spreading, coriaceous, rather rigid, usually linear-lanceolate, sometimes lanceolate or narrow-lanceolate, rather abruptly or gradually

narrowed into the very short petiole, usually very abruptly narrowed towards the apex, the apex rather obtuse to acute, sometimes mucronate or with a short, obtuse apiculus, 3—10 cm long by 6—10 (rarely 4—12) mm broad, 6—9 (rarely 5—12) times as long as broad; midrib narrow, strongly prominent, sharply delimited above, somewhat keeled towards the base, broad towards the apex, broad- and shallow-channelled beneath; lamina with flat margins, shining and often striped above, more dull beneath. Male flower buds in bundles of 3—5 in the upper leaf axils, sessile, globose or ovate-globose, obtuse; bud scales roundish or ovate, usually obtuse, rarely rather acute, to 2 mm long, with membranous, lacerated margin; flowers cylindrical, 2—4.5 cm long, 2.5—3 mm in diam.; stamens with short, broad-triangular, rather acute apiculus; pollen grains with 2 air bladders. Female flowers solitary in the upper leaf axils, usually several together crowded just below the terminal bud, with short peduncles; receptacle composed of 2 fleshy bracts. Peduncles divaricate, or spreading under a wide angle or rarely somewhat reflexed, thick, very short, 1—4 mm long; receptacle erect or erect-spreading, subcylindrical, the sterile posterior bract with short, acute apex, 1—1.5 mm shorter than the anterior fertile bract, which is up to 10 mm long; foliola subulate, 2 mm long; seed elliptical, sometimes somewhat oblique, 9 mm long by 7 mm broad, with hard, bony testa; albumen white, with long embryo, 6 mm long by 1 mm in diam., cotyledons 2, 1.5 mm long, directed upwards. (Description from all the materials examined.) Cfr. *Fig. 4, Plate V 19a—c.*

According to herbarium labels, *P. polystachya* is usually a small tree, to 18 m tall, with a bole to 43 cm in diam., and often branched from near the base. The female flower is green (Bünnemeijer 7685), white (Becking 69) or purple (Boschpr. b.b. 2476), whereas the fruit is black-purple (Bünnemeijer 7685) or red (Boschpr. b.b. 2476). The male flowers are greenish white (Cult. in Hort. Bot. Singapore). This species is one of the few that occur especially at low elevations and only rarely in somewhat mountainous regions. It often grows on the seashore or along rivers, sometimes on grounds which are periodically or continually flooded, *e. g.*, in mangrove swamps, or between granite rocks along the seashore.

The materials available are rather homogeneous, though there are a few deviating specimens. A plant, *e. g.*, from Bangka, Djeboes (Teysmann s. n.) has leaves, which are scattered all over the twigs, much longer and nearly linear; the leaves are to 13 cm long, 7—11 mm broad and 10—12 times as long as broad. Probably this collection

represents a young sapling. Of another plant, from Riau, Tandjoeng Pinang (Teysmann s. n.), the leaves are small and narrow, and not abruptly, but usually rather gradually narrowed towards the apex, and to 13.5 times as long as broad. The leaves of some other plants show the normal shape, but are much smaller and only 3—6 cm long and 4—7 mm broad; some of these plants, however, have leaves of the normal size besides. Still other plants, *viz.*, Bünnemeijer 2351, from Bangka, Burkill 853, from P. Tinggi, and Labohm 1214, from Borneo, have leaves, the shape of which approaches that of *P. neriifolia* by the more gradually narrowed apex and by the midrib less distinctly channelled beneath. In the specimen Clemens 9659, the peduncles are moreover somewhat longer than usually.

On two plants female flowers occur with two fertile scales on the receptacle instead of one. On Ridley 1441 (Pahang) the two ovules are placed opposite to each other, whereas a free, small apex occurs between the two ovuligerous scales. On a plant from Awang Bangkal (unknown coll. 2360) only one of the two ovules is developed to a seed, whereas the other one has remained small.

P. polystachya was united with the species *P. neriifolia* by Hooker fil. It differs, however, from the latter species in the short, crowded peduncles, the bundles of 3—5 male flowers, the erect-spreading crowded leaves with abruptly narrowed apex, and the broad-channelled midrib beneath.

MALAY PENINSULA. Pahang: Kwantan, *For. Dep.* 3555 coll. *Lanubak*, v.n.: jati laut (S, m, f); Kwantan, edge of mangrove Kuala Rumpin, *For. Dep.* 4159 coll. *Watson*, v.n.: jati (S, m); Kuala Pahang, mangrove swamp, *Ridley* 1441 (S, m, f); Rantau Panjang, *For. Dep.* 15441 coll. *Bidin*, v.n.: jati laut (S, f); Sungei Bebar, *For. Dep.* 14979 coll. *Mahamud*, v.n.: jati laut (S, f); P. Tioman, Telok Paya, sea shore, sea level, *Sing.* Field no. 8420 coll. *Henderson* (B, S, f); Johore: Sungei Tukong estate, *Gordon Spare* 959 (S, m); P. Tinggi, *Sing.* Field no. 853 coll. *Burkill* (S, s); Singapore: *Cantley* 113 (S, m); Serangoon, *Ridley* 3367 (S, m); Labrador, *Sing.* Field no. 32795 coll. *Corner* (S, f); Changi, *Ridley* 4823 (S, m); Kranji, *Ridley* s. n., 165 and 4823b (S, f); Singapore, *Wallich* 6052B; *Jelinek* in Exp. Novara (ex *Pilger* 1903 l. c.); Changi beach, *Ridley* 6001 (ex *Ridley* 1911, l. c.).

RIAU ARCHIPELAGO. Br. Belobang, 2 m el., *Bünnemeijer* 7685, v.n.: batang tada (B, f); Tandjoeng Pinang, sea shore, *Teysmann* s. n. (B, L, s).

LINGGA ARCHIPELAGO. Tandjoeng Djakong, *Teysmann* s. n. (B, L, m); P. Temiang, Gg. Benaja, 5 m el., *Bünnemeijer* 7636, v.n.: kajoe karamat (B, L, f); P. Singkep, Batoepetjan, M. Toewa, 1 m el., sea shore, flooded by silt water, *Boschpr.* b.b. 5888, v.n.: mentada (B, s); P. Singkep, S. Manggoe, 8 m el., *Boschpr.* b.b. 5614, v.n.: pentada (B, m).

BANGKA. *Coll. unknown*, no. 16B, v.n.: poenjoek (L, s); Djeboes, *Teysmann*

s. n., v.n.: poenjok (B, G, m); *Teysmann* s. n., v.n.: poenjok (B, G, s); Djeboes, Klabatbaai, sea shore, *Teysmann* s. n. (B, G, f); Soengeiliat, sea shore, *Tesymann* s. n., v.n.: poenjoo (B, G, f); between Pangkalpinang and Blinjoe, 5—10 m el., young bloekar, *Huitema* 12, v.n.: kajoe poenjoe poenjoe (B, s); subdiv. Toboali, 10 m el., sea shore among granite rocks, *Bünnemeijer* 2351 (B, m).

BILLITON. Mangrove near Sidjoek, *Ham* 49, v.n.: kajoe tjina (B, s); Mine distr. Dendang, Gg. Gersik (Membalong), 2 m el., *Boschpr.* b.b. 12428, v.n.: poenjo (B, s).

ANAMBA AND NATOENA ISLANDS. P. Djemadja, Padang nr. Letong, sea level, *Sing.* Field no. 20333 coll. *Henderson* (B, S, m).

KARIMATA ARCHIPELAGO. Soengei Tajan, *Teysmann* 11360, v.n.: mentadeh (B, L, f).

BORNEO. British North Borneo: Kudat, *Fraser* 48 (ex *Stapf,* l. c.); Jesselton, *Clemens* 9659 (B, f); Jesselton, on sandstone banks of beach near harbour, *Clemens* 51171 (L, f); Jesselton, near the harbour, *Gibbs* 2592 (ex *Stapf,* l. c.); P. Labuan, on the sea shore, *Motley* 360 (ex *Stapf,* l. c.); Sarawak: *Beccari* 591, 2213, 2513 (ex *Stapf,* l. c.); *Bur. Sci.* 2353 nat. coll. (ex *Merrill* 1921, l. c.); island Satang Basa, rocky beach, *Foxworthy* 417 (ex *Foxworthy* 1911, l. c.); Western Part: Palo, S. Rijan, 0 m el., mangrove, *Becking* 69, v.n.: kajoe tjina (B, f); Singkawang, Pasir Pandjang, beach, *Dunselman* 166 (B, f); subdiv. Beneden Matan, S. Memboeloeh, 0 m el., periodically flooded by brackish water, *Boschpr.* b.b. 14403, v.n.: tentada (B, f); Southern Part: Bandjermasin, *Motley* 604 (ex *Stapf* l. c.); subdiv. Martapoera, S. Langsat, Karingintan, *Ramli* 2338, v.n.: sarai (B, f); Awang Bangkal, *unknown coll.* no. 2360, v.n.: sarai (B, f); mountanous grounds, *Boschpr.* b.b. 2476, v.n.: sarai (B, f); G. Boekit Besar, *Labohm* 1214, v.n.: kajoe-sarai (B, L, f).

JAVA. Meester Cornelis, cultivated, *Backer* s. n. (B, m).

TALAUD ISLANDS. Karakelang, G. Piapi (ex *Lam* 1926, l. c.).

PHILIPPINES. Batanes Islands (ex *Merrill* 1908, l. c.); Luzon: prov. Ilocos Norte, Burgos, *Bur. Sci.* 27146 coll. *Ramos* (B, L, f); Tayabas prov., *Bur. Sci.* 26902 coll. *Edaño* (L, S, m); *Bur. Sci.* 13202 coll. *Foxworthy & Ramos* (ex *Foxworthy* 1911, l. c.); Bucas Island: *Merrill* 5268 (B, L, f); Palawan: *Bur. Sci.* 904 coll. *Foxworthy* (B, m, f); *For. Bur.* 3854 coll. *Curran* (B, L, m).

Cultivated: in Hort. Bot. Singapore (S, f, s); *Ridley* 13304 (S, f); *Ridley* s.n. (S, m); in Hort. Bot. Buitenzorg, *Pulle* s. n., (U, f); no. V. F. 1, 1a from Lingga Arch. (B, L, W, f); V. F. 17, 17a from Lingga Arch. (B, L, U, W, m).

P. polystachya var. *β* **rigida** Wasscher, n. var.

Folia crasse coriacea, rigidissima, magis lanceolata vel oblongo-lanceolata quam in specie, marginibus non parallelis, 3—7.5 cm longa, 8—14 mm lata, 4—6 × longiora quam lata, costa facie superiore crassa, acriter delimitata, facie inferiore leviter lateque sulcata.

Leaves thick-coriaceous, very rigid, more lanceolate or oblong-lanceolate, with the margins not parallel, 3—7.5 cm long by 8—14 mm broad, 4—6 times as long as broad; midrib strongly prominent, sharply delimited above, very distinctly, broadly and shallowly channelled

beneath; lamina with somewhat recurved margins. (Description from the type specimen.)

This variety differs from the main form of the species in its different leaf shape. Probably it also occurs at higher elevations.

The 2 other collections are less typical than the plant from Karimata; Bünnemeijer 7870 has leaves up to 10.5 cm long, up to 12 mm broad, and less coriaceous; the fruit is not different from that of the main form. The leaves of Hallier B. 2373 are lanceolate and very rigid, and have distinctly channelled midribs; they are up to 10 cm long and up to 12 mm broad. Both collections show an approach towards *P. neriifolia,* but differ in the erect-spreading leaves, with less narrowed apex and channelled midribs.

RIAU ARCHIPELAGO. P. Karimon, G. Djantan, 430 m el., *Bünnemeijer* 7870, v.n.: petada (B, f).

KARIMATA ARCHIPELAGO. G. Djoengdjoeng, *Teysmann* 11358, v.n.: mentadeh darat (B, L, s), type specimens of the variety.

BORNEO. Western Part: G. Kelam, *Hallier* B. 2373 (B, L, s).

20. Podocarpus macrophylla D. Don ssp. **maki** Siebold, Naamlijst (1844) 35, n. 273. For synonyms and literature see Pilger, in Engl., Pflanzenr., IV, 5 (1903) 80.

Twigs subverticillate, spreading, terete. Terminal buds ovate-acute; bud scales ovate-triangular, subulate-acuminate, often with the apex curved outwards, keeled, to 4 mm long. Leaves scattered, usually strongly crowded at the apex of the twigs, erect, somewhat spreading, thin-coriaceous, rather rigid, narrow-lanceolate, usually somewhat spathulate, very gradually narrowed towards the sessile base, more abruptly so into, or rounded above, the usually obtuse, rarely somewhat acute apex, 3—7.5 (rarely to 10) cm long by 4—7 mm broad, 7—12 times as long as broad; on the upper surface the midrib prominent, narrow, sometimes little sharply delimited, often indistinct towards the apex, on the lower surface somewhat broader, slightly keeled towards the base, more flat towards the apex, sometimes slightly channelled; lamina with rather strongly recurved margins, slightly shining above, dull beneath. Male flower buds in bundles of 3—5, especially in the upper leaf axils, sessile, ovate-globose, obtuse; bud scales ovate or ovate-triangular, with membranous, lacerate margin, the outer ones usually somewhat acute, the inner ones obtuse; male flowers narrowly cylindrical, nearly filiformous, 3—4 cm long and 2—3 mm in diam.; stamens with triangular, acute apiculus, with membranous margin. Female flowers single in the upper leaf axils, usually several together crowded just below the terminal bud, with rather long peduncles; receptacle

composed of 2—3 fleshy bracts. Peduncles erect-spreading, somewhat flattened, 5—14 mm long and 1.5 mm broad above; foliola subulate, 2—6 mm long; receptacle subcylindrical, 6—16 mm long by 2.5—8 mm in diam.; seeds 1, rarely 2, globose-elliptical, rounded at the apex and the base, 8—10 mm long by 7—8 mm broad. [Description from plants from the Malay Archipelago (cultivated) and Japan].

According to herbarium labels, this subspecies is a small tree, according to Boschpr. b.b. 15553 with an acute-conical crown. From *P. polystachya*, with which it mainly agrees, it is easily to be distinguish by the narrower leaves with very gradually narrowed base, often rounded, obtuse apex, and recurved margins, moreover by the thinner male flowers and the longer peduncles of the female flowers.

BORNEO. Western Part: Poentianak, sea level, *Boschpr.* b.b. 15553, cultivated? (B, m).

Cultivated: in Hort. Bot. Singapore (S, f, s); Hort. Bot. Penang (S, f, s); Hort. Bot. Buitenzorg, no. V. F. 16—16a, 19—19a, 22—22a, 29—29a, 93, all from Japan (all B, s).

Further distribution: Japan; China (cultivated). Moreover cultivated in Java (according to *Pilger*, l. c.)

21. Podocarpus thevetiaefolia Zippelius, in Alg. Konst- en Letterbode (1829) 298, nomen; in Flora, 12 (1829) 287, nomen; Blume, in Rumphia, 3 (1847) 213; Walpers, Ann. Bot. Syst., 3 (1852) 449; Miquel, Fl. Ind. Bat., II, 6 (1859) 1074; Henkel & Hochstetter, Syn. Nadelhölz. (1865) 397; De Boer, Conif. Arch. Ind. (1866) 22, 28, 36, 37, t. II, 3; De Kirwan, Conif., 2 (1868) 229; Parlatore, in D.C., Prodr., 16, II, 2 (1868) 518; Gordon, Pinetum, ed. 2 (1875) 349; Scheffer, in Ann. Jard. Bot. Buitenz., 1 (1876) 52; Beccari, Malesia, 1 (1877) 180; Warburg, in Bot. Jahrb., 13 (1891) 256; Monsunia, 1 (1900) 192; [1]) Pilger, in Engl., Pflanzenr., IV, 5 (1903) 79; [1]) in Bot. Jahrb., 54, 3 (1916) 209; [1]) Lane-Poole, For. Res. Pap. (1925) 74, 41; [1]) Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 248; [1]) Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 280, 283. — *Nageia thevetiaefolia* F. von Mueller, Descr. not. Pap. pl., 1 (1875) 93; Kuntze, Rev. Gen. Plant., 2 (1891) 800. — *Podocarpus polystachya* (non R. Brown) Engler, in Bot. Jahrb., 7 (1886) 445.

[1]) *P. thevetiifolius.*

Twigs solitary or some of them verticillate, spreading, straight or curved, slender; usually moreover numerous short twigs, 2—12 mm long, sprouting from the branches. Terminal buds very small, ovate-acute; bud scales adpressed, ovate-triangular, acute, 1.5 mm long, keeled. Leaves scattered, rather remote, but crowded and almost subverticillate

below the apices of the branchlets, usually 3—6 subverticillate on the short twigs, spreading or divaricate, thin-coriaceous, rather flexible, narrow-lanceolate, or linear-lanceolate, sometimes (especially on the short twigs) somewhat spathulate, gradually narrowed into the short or indistinct petiole, usually abruptly narrowed, or rounded or more gradually narrowed towards the acute or obtuse, rarely mucronate apex, 2.5—8 cm long by 5—9 mm broad; midrib on the upper surface usually not or hardly prominent, or sometimes slightly broad-impressed towards the apex; on the lower surface more distinct, somewhat keeled towards the base, not or slightly prominent, flat or rounded towards the apex; lamina with almost flat margins, shining and striped above, somewhat shining beneath, with distinct, narrow, shining line along the margins. Male and female flowers unknown. Peduncles single in the upper leaf axils, slender, 3—8 mm long; receptacle (according to Blume) twice as thick as the seed; seed elliptical, 10 mm long by 6 mm broad. (Description from all the specimens examined.) Cfr. *Fig. 4*.

P. thevetiaefolia differs from the allied species in the usually obtuse, sometimes acute leaves, with the midrib not or hardly prominent, sometimes impressed on the upper surface. According to Lane-Poole, it is a small tree, nearly 23 m tall, with a bole of nearly 16 m. On the summit of Mt. Obree it is said to occur in a dwarfed form. Also some plants, collected near Ansoes, and other ones, with much smaller leaves, from the summits of the Arfak Mts., both with very acute and very strongly acuminate bud scales, were included in this species by Beccari. I had not the opportunity of examining any of this plants.

NEW GUINEA. N.W. Part: Lobo, *Zippelius* s.n. (B, G, L, U, f), originals of the species; Sekar, *Naumann* N.G. 43 (BD, f); Sekar, on the rocky sea shore, *Warburg* 21128 (BD, s).

22. Podocarpus Pilgeri Foxworthy — *Podocarpus celebica* (non Hemsley 1896) Warburg, Monsunia, 1 (1900) 192; (*-us*) Pilger, in Engl., Pflanzenreich, IV, 5 (1903) 78, cum f. *montana*. — *Podocarpus Pilgeri* Foxworthy, in Philipp. Journ. Sci., 2 (1907) Bot. 259; in Philipp. Journ. Sci., 6 (1911) Bot. 160; Pilger, in Bot. Jahrb., 54, 1 (1916) 38; Merrill, Enum. Philipp. Flow. Pl., 1 (1923) 3; 4 (1926) 96; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 248; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 280, 283. — *Podocarpus costalis* Foxworthy, in Philipp. Journ. Sci., 6 (1911) Bot. 161 p.p.; Merrill, Enum. Philipp. Flow. Pl., 1 (1923) 2 p.p.; Lam, in Nat.

Tijdschr. N. I., 88 (1928) 303; Fragmenta Papuana, 5 (1928) 166. — *Podocarpus Schlechteri* Pilger, in Bot. Jahrb., 54, 3 (1916) 209; in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 248; Lauterbach, in Bot. Jahrb., 63 (1930) 474; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 280, 283; Pilger, in Bot. Jahrb., 68 (1936) 246.

Twigs scattered or to 5 subverticillate, sometimes branched from the twigs, spreading, straight or curved, terete, slender, sometimes with thickened base. Terminal buds ovate-acute to narrowly conical; bud scales usually narrowly ovate-triangular, sometimes more lanceolate, acute, sometimes short- to rather long-acuminate, keeled, to 4.5 mm long. Leaves rather remote, often crowded and subverticillate near the apex of the vegetation periodes and below the terminal buds, spreading, thin- to very thick-coriaceous, very rigid or slightly so, flat or sometimes folded upwards along the midrib, broadly linear-lanceolate, oblong-lanceolate to oblong, or short- or rather long-lanceolate, very gradually to cuneately narrowed into the short petiole, either abruptly rounded towards the obtuse apex, sometimes with a short, obtuse apiculus, or abruptly to rather gradually narrowed in the rather acute apex, sometimes with a short, obtuse apiculus, or abruptly to rather gradually narrowed in the rather acute apex, sometimes with a thin mucro, 1.5—8 cm long by 4—13 mm broad, 2.5—7 times as long as broad; midrib on the upper surface strongly prominent, narrow, sharply delimited, on the lower surface often somewhat keeled towards the base, not or slightly prominent, flat or round, sometimes slightly channelled towards the apex; lamina with flat or slightly recurved margins, more or less shining above, more dull beneath, usually striped on both surfaces. Male flower buds single in the leaf axils, sessile or nearly so, rather small, ovate-globose; bud scales ovate and obtuse, or more ovate-triangular and acute or slightly acuminate; male flowers cylindrical, 1.5—5 cm long and 2—3.5 mm in diam.; stamens with triangular or ovate, acute or rather obtuse apiculus, with membranous margin. Female flowers single in the leaf axils, rather remote, with rather short, slender peduncles; receptacle composed of 2 fleshy bracts, the fertile scale with obtuse free margin, the sterile one with acute apex. Peduncles slender, somewhat flattened, 3—12 mm long; receptacle subcylindrical, 5—12 mm long by 3—7 mm broad; foliola small, subulate, 1.5—2 mm long; seed elliptical-ovate or elliptical-globose, obtuse, 8—8.5 mm long and 7 mm broad. (Description from all the specimens examined.) Cfr. *Fig. 4*.

P. Pilgeri is, according to herbarium labels, usually a small tree or shrub 4—15 m tall; according to Clemens, however, a tall

tree. The bark is brown (Ledermann), and yields much red-brown sap (Boschpr. b.b. 23816). The crown is widely branched (Lam 2163), sparsely leaved (Ledermann 11447), or small and dense (Ledermann 12755). The male flowers are yellow-white (Ledermann 11447), the fruit green with bluish bloom (Ledermann 12755), or red (Ledermann 12755). The species mainly grows in the higher parts of the mountains, especially between 1400 and 3000 m el. It differs from its nearest allies, *P. thevetiaefolia* and *P. costalis,* in the strongly prominent mid-rib. From *P. polystachya* it may be distinguished by the longer peduncles of the female flowers, the solitary male flowers, and the leaf shape.

As regards the leaf shape, this species shows a large variability. One extreme is represented by Warburg's type specimens. The leaves of this are broadly linear-lanceolate to elliptical, and usually rounded at the apex. With these plants agree those from Mt. Banajao, Luzon, which were included in *P. costalis* by Foxworthy, and those from Mt. Bantaèng (Celebes) collected by Teysmann, and from Mt. Doorman (New Guinea). Warburg 16890, Pilger's type specimen of the forma *montana*, and the collections Boschpr. b.b. 17672 and Abendanon s. n. from Celebes, and For. Bur. 4673 from Mindanao, which all are plants from very high mountain summits, have thicker and much more rigid, often more short-lanceolate leaves with more acute apex, whereas the twigs are more densely leaved. The other extreme is represented by the plants with narrower, more lanceolate leaves, which are drawn out into a fine point, *e. g.*, the collections Carr 13721, Brass 4034 and Schlechter 18781 from New Guinea, Merrill 241 from Negros, and Elmer 14086 from Mindanao. Also the other specimens which were included in the species *P. Schlechteri* by Pilger usually have smaller, more lanceolate leaves. Between these extremes there occur, of course, many intermediates, often even on one branch. The flowers and fruits, however, are always the same.

The specimen Boschpr. b.b. 22572, from New Guinea, is taken from a young tree or shrub, with the short twigs very strongly bent to and fro, and with very small, thin-coriaceous, nearly spathulate leaves with obtuse apex. The leaves are 1—2.5 cm long by 2.5—5 mm broad, and 3.5—5 times as long as broad. I have not taken up the latter specimen in the description in order to make it not unnecessarily vague. Yet I believe it must be included in the species too. In some respects, the plant from Obi may be regarded as an intermediate between the latter plant and the other collections. It has, however, long internodes, and

the small, lanceolate leaves are all crowded at the apices of the vegetation periods. This collection also comprises a seedling, the roots of which bear root nodules.

PHILIPPINES. Luzon: prov. Laguna and Tayabas, Mt. Banajao, 1700—2200 m el., *Bur. Sci.* 19581 coll. *Ramos* (L, f); *Bur. Sci.* 2393 coll. *Foxworthy* (B, s); *Elmer* 7778 (B, L, f); Mindoro, Mt. Halcon, 2150 m el., *Merrill* 5754 (ex *Foxworthy* 1911, l. c.); Negros, Mt. Canlaon, 1450 m el., *Merrill* 241 (U, s); Mindanao, subprov. Bukidnon, Mt. Lipa, *Bur. Sci.* 38500 coll. *Ramos & Edaño* (B, L, f); prov. Misamis, Mt. Malindang, 2790 m el., *For. Bur.* 4673 coll. *Mearns & Hutchinson* (B, L, s); prov. Agusan, Cabadbaran, Mt. Urdaneta, *Elmer* 14086 (B, L, U, m).

CELEBES. Central Celebes, Boeloe Palaka, *Abendanon* s. n. (B, L, s); South Celebes, Wawo Kraèng, *Warburg* 16891, type of *P. celebica Warburg* (BD, s); Wawo Kraèng, summit, ca. 2850 m el., *Warburg* 16890, type of *P. celebica* f. *montana Pilger* (BD, s); Wawo Kraèng, Tjamba-Manipi, *Warburg* 16433 (BD, s); subdiv. Gowa, summit of the Bawa Karaèng, 2800 m el., naked rock, *Boschpr.* b.b. 17672, v.n.: aho-aho (B, s); Gowa, Lembaja, 1800 m el., *Boschpr.* b.b. 20233, v.n.: aho (B, m); Gowa, Lembaja, Beroe, above 2000 m el., *Boschpr.* b.b. 20437, v.n.: aho, aho aho, aho gana (B, s); Bantaèng Peak, *Everett* 37 (S, s); Lanjienga, *Teysmann* 14121, v.n.: santigi romang (B, L, s); *Teysmann* 14191, v.n.: tjantigi (B, L, s).

MOLUCCAS. Obi, Hol Djikodolong Kawashi, 700 m el., *Boschpr.* b.b. 23816 (B, s).

NEW GUINEA. N.W. Part: Mt. Genofa, 1000 m el., *Boschpr.* b.b. 22572 (B, s); ridge to Mt. Doorman, 1750 m el., *Lam* 2163 (B, s); N.E. Part: Bismarck Mts, 2000 m el., *Schlechter* 18780 (BD, m); *Schlechter* 18781 (BD, f); Kaiserin Augusta Fluss Exp., Hunsteinspitze, 1300 m el., *Ledermann* 11399 (BD, f); *Ledermann* 11447 (BD, m); Felsspitze, 1400—1500 m el., *Ledermann* 12755 (BD, f), among the latter 5 collections the originals of *P. Schlechteri Pilger*; Morobe distr., Ogeramnang, 1875 m el., *Clemens* 4569 (BD, m); 1900 m el., *Clemens* 4696 (BD, f); S.E. Part: Boridi, 1900 m el., *Carr* 14556 (L, m); *Carr* 14563 (BD, s); above the Gap, 2550 m el., *Carr* 13721 (BD, L, m); Central Division, Mt. Tafa, 2300 m el., *Brass* 4034 (BD, s).

SOLOMON ISLANDS. Ysabel Island, Mt. Sasari, 1100 m el., *Brass* 3265 (B, s).

23. **Podocarpus brevifolia** (Stapf) Foxworthy — *Podocarpus neriifolia* D. Don var. *brevifolia* Stapf, in Transact. Linn. Soc., Bot., sér. 2, IV (1894) 249, 87; (*-us*) Pilger, in Engler, Pflanzenr., IV, 5 (1905) 93. — *Podocarpus bracteata* var. *brevifolia* Stapf, in Transact. Linn. Soc., Bot., sér. 2, IV (1894) 103. — *Podocarpus brevifolius* Foxworthy, in Philipp. Journ. Sci., 6 (1911) 160, t. 29, ic. 2; Gibbs, in Journ. Linn. Soc., Bot., 42 (1914) 30, 31, 32, 35, 36, 41; Stapf, in Journ. Linn. Soc., Bot., 42 (1914) 194; Pilger, in Bot. Jahrb., 54, 1 (1916) 40; Merrill, Bibl. enùm. Born. pl. (1921) 31; Enum. Philipp. Flow. Pl., 1 (1923) 1; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 279, 283.

Twigs usually to 3—4 verticillate, spreading or erect-spreading, with very short, 1—5 cm long vegetation periods, rather stout. Terminal buds acute; bud scales usually narrow-triangular, sometimes ovate

or broad-triangular, acute or short-acuminate, rarely somewhat obtuse, keeled, 3—7 mm long, usually persistent for a great portion on 3—7 vegetation periods. Leaves scattered on at least 3—5 vegetation periods, very densely crowded, erect, adpressed on the twigs, imbricate, thick-coriaceous, very rigid, flat, or, especially towards the base, slightly folded upwards along the midrib, straight or very slightly falcate, lanceolate, sometimes more lanceolate-oblong or narrow-lanceolate, usually rather gradually, sometimes long- or rather short-narrowed in the acute or rarely slightly rounded apex, gradually or rather short-narrowed into the short and broad petiole, sometimes sessile with broad base, 1.5—5.5 cm long by 4—7 mm broad, 3—8 (usually 4—6) times as long as broad; midrib on the upper surface distinct, prominent, narrow, indistinct towards the apex, on the lower surface broader, usually somewhat keeled towards the base, for the rest more flat, rarely thick and rounded, often slightly shallow- and broad-channelled; lamina usually with rather strongly recurved margins, sometimes rather flat, somewhat shining above, more dull beneath. Male flowers single in the upper leaf axils, sessile, thick-cylindrical, 2—3 cm long and 4—5.5 mm in diam, at the base with some sterile bud scales, of which the outer ones often somewhat acute, keeled, to 2 mm long, the inner ones ovate, obtuse, more membranous, to 4 mm long and 3 mm broad; stamens with rather long, ovate or ligulate, obtuse apiculus; pollen grains with 2 air bladders. Female flowers single in the leaf axils, several crowded in a short zone just below the terminal buds; peduncles short, broad, strongly flattened, erect-spreading; receptacle composed of 2 fleshy bracts, the fertile one turned towards the twig, with obtuse, free margin, the sterile one with rather long, free apex. Peduncles 2—4 mm long; foliola subulate to narrow-triangular, rather broad, acute, keeled, 3—5 mm long; receptacle subcylindrical, 5—6.5 mm long by 2.5—4 mm broad; seed (unripe) elliptical, somewhat narrowed towards the base and the apex, obtuse, 9 mm long by 4 mm broad. (Description from all the specimens examined.) Cfr. *Fig. 4.*

According to herbarium labels, *P. brevifolia* is a shrub or small tree, especially growing in dwarfed-tree forests on the summits of high mountains. The male flowers are light green (Clemens 27826 = 27103). It is a very distinct species in its adpressed, small, lanceolate, thick-coriaceous leaves.

PHILIPPINES. Luzon: Zambales prov., Tapulao, 1800 m el., *For. Bur.* 9511 coll. *Curran & Merritt* (B, f); *Bur. Sci.* 5002 coll. *Ramos* (ex *Foxworthy* l. c.); Mindanao, Bukidnon, 2000 m el., (ex *Merrill* 1923, l. c.).

BORNEO. British North Borneo: Mt. Kinabalu, 3330—3630 m el., *Low* (ex *Stapf* 1894, l.c.); *Haviland* 1093 (S, m), originals of the species; above Lobang, 2000—4000 m el., *Gibbs* 4166 (ex *Stapf* 1914, l. c., also Maraiparai spur, ca. 1350—1700 m el.); Paka Cave to Low's Peak, *Clemens* 10657 (B, f); above Paka, ca. 3650—4100 m el., *Clemens* 27826 = 27103, (B, m); *Clemens* 27825 = 27103 (L, m); *Clemens* 28901 (B, L, f); Gurulau spur, 3650—4000 m el., *Clemens* 50825 (L, m).

24. Podocarpus glauca Foxworthy, in Philipp. Journ. Sci., 2 (1907) Bot., 258; 6 (1911) Bot., 159, t. 29, ic. 1; Merrill, Enum. Philipp. Flow. Pl., 1 (1923) 3; Pilger, in Engl. & Pr., Nat. Pflanzenfam., ed. 2, 13 (1926) 248; Florin, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 262, 263, 265, 266 (all *P. glaucus*).

Twigs solitary or usually to 3—5 verticillate, spreading, straight or curved, with very short, 1.5—5 cm long vegetation periods. Terminal buds narrowly ovate-conical, rarely ovate; bud scales usually narrow-triangular, sometimes narrowly ovate-triangular, acute, often slightly long-acuminate, rigid, keeled, 3—5 mm long, usually deciduous. Leaves scattered, densely crowded, erect, sometimes slightly erect-spreading, adpressed to the twigs, nearly imbricate, thick-coriaceous, very rigid, somewhat rounded downwards, oblong to short-lanceolate, rather gradually narrowed into the hardly distinct petiole, abruptly narrowed or rounded towards the rather obtuse apex, 10—22 mm long by 3.5—6 mm broad, 3—5 times as long as broad; midrib on the upper surface distinct, prominent, narrow, indistinct towards the apex, on the lower surface broader, thick-prominent, round or flat, often shallowly channelled; lamina with strongly recurved margins, shining above, dull beneath, with exception of the shining midrib. Male flower buds single in the leaf axils, sessile, narrowly ovate-acute or narrowly ovate-conical; bud scales narrow-triangular, acute, or from an ovate-triangular base rather strongly acuminate, rigid, keeled, to 4 mm long; male flowers cylindrical, rather slender, 1—3 cm long and 2—3 mm in diam.; stamens with rather long, triangular or ligulate, rather obtuse or acute apiculus. Female flowers single in the leaf axils, some of them crowded just below the terminal bud; peduncles very short, to 1 mm long; foliola subulate-triangular, keeled, to 2.5 mm long; receptacle erect, composed of 2 fleshy, curved bracts, about 3 mm long, the sterile bract with short, acute apex; ovule subelliptical, narrowed towards the base and the apex, obtuse; ripe seed unknown. (Description from all the specimens examined.) Cfr. *Fig. 4*.

According to herbarium labels *P. glauca* is a small tree nearly up to 17 m tall. It is only known from Mt. Halcon, Mindoro, at 2400 m

el., and is based upon the only specimen Merrill 5672, which I had not the opportunity to examine. The collections mentioned below agree with Foxworthy's description, though the midrib is prominent on the upper surface, whereas Foxworthy describes it as not being prominent above. In spite of this, the collections of Mt. Kinabalu must, in my opinion, be included in this species provisionally. *P. glauca* was provisionally included in the section *Stachycarpus* by Foxworthy, but it is not clear why he did so. By Pilger, however, it was included rightly in the section *Eupodocarpus*.

The collection Clemens s. n. deviates from the description above by leaves which are more lanceolate, 2—3.5 cm long, 4—7 times as long as broad, whereas the apex is rather gradually or short-narrowed, rather acute or obtuse; but the leaves are strongly recurved at the margins and have the same olivaceous colour as the other specimens.

P. glauca is much allied to *P. brevifolia,* but differs in the smaller, more oblong leaves, with rounded, obtuse apex and strongly recurved margins.

Philippines. Mindoro: Mt. Halcon, 2400 m el., *Merrill* 5672 (ex *Foxworthy* l. c.).

Borneo. British North Borneo: Mt. Kinabalu Marai Parai, 1700 m el., *Clemens* 32021 (B, L, m); Colombon basin, W. crest of Numeruk ridge, 1700 m el., *Clemens* 40001 (B, L, m); Penibukan ridge, 1500 m el., *Sing.* Field No. 26450 coll. *Carr* (S, f); 1300—1700 m el., *Clemens* s. n. (B, L, s).

25. **Podocarpus Brassii** Pilger, in Bot. Jahrb., 68 (1936) 246.

Twigs usually to 3—8 subverticillate, spreading, stout, straight, terete, rigid, sulcate and striped. Terminal buds large, subglobose; bud scales numerous, often spreading, sometimes partly persistent on some vegetation periods, lanceolate or narrow-triangular, sometimes ovate-triangular, acute, gradually narrowed or slightly acuminate, keeled, with membranous margin, up to 8 mm long. Leaves scattered, more or less crowded, or even imbricate, usually erect-spreading, very thick-coriaceous, very rigid, elliptical-oblong, shortly lanceolate or broadly lanceolate-spathulate, rather shortly narrowed or somewhat rounded into the short, broad petiole, shortly narrowed, often slightly rounded towards the apex, usually with short apiculus, sometimes mucronate, 10—18 mm, rarely to 20 mm long by 3—7 mm broad, usually 2—4, rarely up to 5 times as long as broad (the more lanceolate leaves of young plants with a thin mucro and up to 4 cm long); midrib narrow, strongly prominent, often indistinct towards the apex above, broader, usually thick-prominent, rounded or flat beneath; lamina with flat or

slightly recurved margins, usually shining above, more dull beneath, with the exception of the shining midrib and a rather broad zone along the margins. Male flower buds single in the upper leaf axils, sessile, rather large, ovate-acute; bud scales slightly spreading, ovate-triangular or narrow-triangular, acute or the inner ones rather obtuse, keeled, with narrow, membranous margin, up to 6 mm long; male flowers thick-cylindrical, 2—3.5 mm long and 3—7 mm in diam.; stamens with rather long, triangular, rather acute apiculus; pollen grains with 2 air bladders. Female flowers solitary in the upper leaf axils. Peduncles short, thick, erect-spreading, terete or somewhat flattened, 2—9 mm long; foliola narrow-triangular, acute, 3 mm long; receptacle subcylindrical or obconical, 5—9 mm long by 2.5—7 mm broad, composed of 2—3 fleshy bracts, of which 1—2 sterile and 1—2 fertile, the sterile ones with free apex, the fertile ones with rather broad or narrow, rather acute free margin; seed elliptical or elliptical-globose, slightly rounded or narrowed towards the base and the apex, 7—10 mm long by 5—6 mm broad. (Description from the specimens mentioned below.) Cfr. *Fig. 4.*

The data on the herbarium labels about the dimensions and shape of this species diverge rather strongly. The specimen Pulle 1023, *e. g.*, is a shrub 2 m tall, often procumbent; Versteeg 2505 is a tree 3 m tall; Lam 1789 a widely branched, 5 m tall shrub; the specimens collected by Brass are 10—12 m tall trees with roundish, densely branched crown; the specimen Clemens s.n. a large tree nearly 27 m tall. The female flowers are glaucous (Brass 4396), the fruit brown, with blue receptacle (Pulle 1023) or greenish purple, with bluish waxy bloom (Lam 1789).

P. Brassii, which is allied to *P. brevifolia*, is easily to recognise by the small, very rigid and thick-coriaceous leaves, with thick- and broad-prominent midrib beneath and the rather broad, shining line along the margins. Usually the peduncles are less flattened than those of *P. brevifolia*. It is a high-mountain species, collected on elevations higher than 3000 m.

New Guinea. N.W. Part: Mt. Doorman, 3200 m el., *Lam* 1789 (B, f); S.W. Part: Wichmann Mts, summit, 3100 m el., *Pulle* 1023 (U, f, m); valley near Meerbivak, 3600 m el., *Versteeg* 2505 (U, m); N.E. Part: Morobe distr., Mt. Sarawaket, 3300 m el., *Clemens* s. n. (B, f); S.E. Part: Central division, Mt. Albert Edward, 3680 m el., *Brass* 4395 (B, BD, f), *Brass* 4395a (BD, s), *Brass* 4396 (B, BD, m), type specimens of the species.

Species recorded for the area, but not confirmed by herbarium materials.

Podocarpus nagi (*Thunberg*) *Pilger*, a species of the section *Nageia*, is said by *Van Eeden* (Houts. Ned. Ind., 1886, p. 136; ed. 3, 1906, p. 256, under the name *P. Nageia R. Brown*), to be cultivated in Java. I only saw specimens from the Buitenzorg Botanic Garden.

Podocarpus elata R. Brown, an Australian species of the section *Eupodocarpus*, is mentioned by *Engler* (Bot. Jahrb., 7, 1886, p. 445) for the area. He included in this species a specimen from Kupang Bay, Timor, collected by *Naumann*. *Pilger*, however, did not mention this specimen in his monograph and apparently it cannot be found in the Berlin-Dahlem Herbarium, as, on special request, I did not receive it for examination.

Doubtful species.

Podocarpus *spec. Stapf*, in Journ. Linn. Soc., Bot., 42 (1914) 194. This represents *Gibbs'* no. 4089 from Mt. Kinabalu, at 5000—8000 ft. el., of which "the leaves are, in shape and size, intermediate between those of *P. brevifolius* and *P. polystachyus*, but thinner and much more loosely arranged than in either". I did not see this specimen. In my opinion it is a form of the alliance of *P. Pilgeri*.

Podocarpus *spec. Stapf*, in Journ. Linn. Soc., Bot., 42 (1914) 194; *Gibbs*, *ibidem*, p. 30 and 32. This record, based upon *Gibbs'* no. 4092 from Mt. Kinabalu, 5—8000 ft, is "a tree, 7—10 m high. A very striking species with fairly crowded leaves, oblong-linear, obtuse or sub-obtuse at the base, 1.5—2 cm long, 3.5—4.5 mm broad, with the recurved margins, the midrib raised above and rather broad and flat beneath". I did not see this specimen either, but I think, it must be included in *P. glauca*.

Species to be excluded from the genus.

Podocarpus falciformis Parlatore, in D.C., Prodr., 16, 2 (1868) 685; *Gordon*, Pinetum (1875) 336; *Rendle*, in Journ. Bot., 34 (1896) 355; *Warburg*, Monsunia, 1 (1900) 193 = **Dacrydium falciforme** (*Parlatore*) *Pilger*, in *Engl.*, Pflanzenreich, IV, 5 (1903) 45.

Podocarpus koraiana Siebold, in Ann. Soc. Hort. Pays-Bas (1844) 34. This species, cultivated in Java according to *Van Eeden* [Houts. Ned. Ind. (1886) 136; ed. 3 (1906) 256], is, after its name, **Cephalotaxus drupacea** *Siebold & Zuccarini*, f. **fastigiata** *Pilger*, in *Engl.*, Pflanzenreich, IV, 5 (1903) 103, but this plant does not occur in Java, neither wild nor cultivated.

Podocarpus palembanica Miquel, Fl. Ind. Bat., suppl. Sumatra (1860) 252, 289, is, according to *De Boer*, Conif. Arch. Ind. (1866) 4, no Conifer: "Haec species ad sterile exemplar descripta et tanquam Podocarpi species ex horto bogoriensi missa, accuratius denuo examinata Coniferarum ligni structuram non ostendit, ad alium ordinem probaliter referenda hic igitur silentio praetereunda". Moreover, *Miquel* mentions lateral ribs in the leaves, which never occur in *Podocarpus*. I do not know where *Miquel's* specimens are preserved now.

Podocarpus celebica Hemsley, in Kew Bull. (1896) 39; *Pilger*, in Bot. Jahrb., 54, 1 (1917) 38. The type specimen *Everett* 35 (S, s) from G. Bantaèng (Celebes),

which I had the opportunity of examining, appeared to be **Taxus baccata** ssp. **Wallichiana** (*Zuccarini*) *Pilger*. To the same conclusion came already *Florin*, in Kungl. Svensk. Vet. Akad. Handl., 10, 1 (1931) 226.

Index of the collectors' numbers

as far as examined by the author, referring to the species by means of their serial number in this paper.

Abendanon: s.n. (2); s.n. (22) — *Achmad:* 1388 (17); 1688 (17) — *Altmann:* 362 (17) — *Amdjah:* 51 (10) — *Arens & Wurth:* s.n. (2, 1) — *Arsin:* 19594 (17); 19690 (2) — *Atasrip:* 40 (16); 118 (10).

Backer: s.n. (2); s.n. (19); 461 (2); 3358 (2); 4922 (2); 5406 (2); 8866 (10); 9604 (2); 10438 (10); 10749 (17); 11050 (2); 12407 (17); 12481 (17); 14329 (2); 14742 (2); 15121 (2); 16157 (2); 21819 (2); 22582 (2); 23017 (2); 23930 (10); 30723 (1); 31326 (2); 31376 (2); 37539 (17) — *Bakhuizen van den Brink:* 740 (2); 1811 (2); 1936 (2); 4422 (2); 4586 (17); 4606 (2); 5981 (1); 7792 (17) — *Bakhuizen van den Brink fil.:* 726 (2); 2553 (2); 3012 (1) — *Bangham:* 1074 (2); 1116 (17) — *Barnes:* 10907 (2) — *Beccari:* P. B. 2649 (11); P. S. 49 (2); P. S. 252 (17); P. S. 295 (1) — *Becking:* 69 (19) — *Den Berger:* 549 (2); 550 (1); 637 (2) — *Berkhout:* 430 (10) — *Blume:* s.n. [1, 2, 2β, 10, 17 (7 ×), 17β (4 ×)] — *De Boer:* 6603 (2) — *Boerlage:* s.n. [2 (2 ×)]; 174 (16).

Boschproefstation, b.b. nummers: 2414 (17); 2436 (2); 2450 (10); 2476 (19); 2768 (2); 2778 (1); 2784 (17); 2924 (1); 4001 (17,ε); 4130 (2); 4866 (2); 5401 (1); 5440 (1); 5443 (2); 5460 (2); 5614 (19); 5888 (19); 6203 (17); 6235 (2); 6368 (11); 6889 (16); 6904 (2); 6934 (2); 7192 (1); 7346 (11); 7708 (2); 8054 (17); 8130 (1); 8351 (1); 8532 (2); 8737 (2); 8740 (17); 8823 (17); 8842 (10); 9003 (2); 9696 (10); 9705 (16); 10123 (16); 10843 (17); 10889 (10); 10964 (10); 11192 (17); 11307 (10); 11335 (10); 11613 (11); 11629 (2); 11739 (10); 11784 (1); 11803 (2); 12196 (17); 12212 (10); 12428 (19); 12602 (2); 13633 (7); 14063 (11) 14385 (16); 14403 (19); 14898 (2); 15085 (17); 15155 (2); 15504 (2); 15553 (20); 15602 (10); 15950 (10); 16997 (1); 17030 (17); 17229 (11); 17269 (2); 17348 (10); 17444((17); 17555 (10); 17582 (1); 17672 (22); 18217 (10); 18328 (11); 18743 (1); 18752 (2); 19559 (2); 19563 (2); 19647 (10); 20061 (17); 20061 (17); 20202 (2); 20204 (17γ); 20233 (22); 20391 (1); 20437 (22); 20785 (1); 20872 (7); 21151 (11); 21274 (2); 21497 (1); 21933 (17); 22247 (1); 22449 (1); 22455 (17); 22498 (17); 22572 (22); 22582 (1); 22647 (10); 22857 (4); 23127 (10); 23136 (10); 23143 (17); 23242 (1); 23257 (10); 23263 (16); 23538 (2); 23816 (22); 23823 (10); 23830 (16); 24158 (17γ); 24173 (2); 24209 (2); 24306 (16); 24914 (17).

Cel. numbers:

II. 285, 286, 287, 288 and 325 (16); III. 80, 143, 144, 145 and 146 (10).

Ja. numbers:

1311 (17); 1356 (17); 1505 (17); 1747 (17); 1873 (17); 1908 (1); 1909 (1); 1925 (2); 3614 (2); 1948 (17); 3986 (2); 3988 (17); 4001 (2).

Other numbers:

E. 1084 (10); 1106 (10); 1143 (10); 1352 (10); 1357 (10); S. W. K./II. 10 (17); T. B. 200 (10); T. B. 214 (1); T. B. 449 (2); 12 T. 1 P. 13 (11); 12 T. 1 P. 185 (11); 192 T. 3 P. 567 (17_ι).

Botanic Garden Buitenzorg: without number (17, 17ζ, 19); XI. B. 24 (2); XI. B. XVI. 56 (2); 8 [XII. B. (VI)] (17); V. F. 1, 1a (19); 3 (17); 9 (10); 9a (16); 13 (10); 16, 16a (20); 17, 17a (19); 19, 19a (20); 20, 20a (16); 21 (17); 22, 22a (20); 24 (2); 27 (1); 28 (2); 29, 29a (20); 31, 31a (16); 33, 33a, 35, 45, 67, 67a, 75a, 78 (17); 82, 82a, 91, 91a (10); 93 (20); 94 (16); 98, 98a (10) — *Botanic Garden Penang:* without number (20) — *Botanic Garden Sibolangit:* 23 (2); 24 (1) — *Botanic Garden Singapore:* without number (2, 19, 20) — *Botanic Garden Tjibodas:* R. 8 (12) — *Branderhorst:* s. n. (8); s. n. (9); 131 (8) — *Brascamp:* 18 (2) — *Brass:* 2881 (14); 3962 (10); 4034 (22); 4284 (8); 4284a (8); 4347 (8); 4348 (8); 4395 (25); 4935a (25); 4396 (25); 4605 (17); 4688 (8); 4768 (2); 4962 (3); 5115 (2); 5878 (10); 5880 (10); 5906 (10); 5907 (17); 5908 (17) — *Bremekamp:* s. n. (1) — *Bruggeman:* 3716 (2) — *Bünnemeijer:* 2341 (10); 2351 (19); 4022 (2); 4340 (2); 7636 (19); 7685 (19); 7870 (19β); 11855 (2); 11903 (2); 11977 (2); 12019 (2) — *Burck:* s. n. (2); 144 (17) — *Bureau of Science, Manila:* 904 (19); 2387 (5); 2393 (22); 4405 (2); 5174 (16); 8328 (2); 19581 (22); 26902 (19); 27146 (19); 27926 (5); 28348 (10); 38500 (22); 45005 (5); 47333 (10) — *Burger:* 6336 (2) — *Burn Murdoch:* 11964 (2) — *Buurman van Vreeden:* 49 (10) — *Bijhouwer:* 105 (2); 222 (2).

Cantley: 113 (19) — *Carr:* 12842 (17); 13264 (2); 13486 (1); 13721 (22); 14160 (12); 14194 (2); 14556 (22); 14563 (22); 14765 (1); 15395 (17); 15666 (12) — *Clason-Laarman:* 184 (2) — *Clemens:* s. n. (10); s. n. (24); s. n. (25); 1231 (10); 1481 (17); 2172 (10); 2276 (17); 2352 (16); 3113 (1); 3323 (2); 3854bis (1); 4569 (22); 4669 (22); 5261 (6); 5325 (1); 5434 (17); 5473 (2); 5562 (6); 5588 (6); 6283 (6); 6578 (17); 6607 (10); 9659 (19); 10636 (2γ); 10657 (23); 16251d (2); 21066 (2); 27092—27854 (2γ); 27854 (2γ); 27826—27103 (23); 28631 (2); 28901 (23); 28910 (2γ); 29779 (2); 29914 (2γ); 32021 (24); 32316 (2γ); 32317 (2γ); 32318 (2γ); 33618 (2); 40001 (24); 50051 (17); 50691 (17); 50825 (23); 51171 (19); 51201 (2γ); 51635 (2) — *Comisión de la Flora Forestal de Filipinas:* 623bis (5) — *Corner:* s. n. (13); s. n. (17) — *Cuming:* 803 (5) — *Curtis:* 3079 (17).

Danser: 5886 (2); 6100 (1); 6792 (17β) — *Diepenhorst:* s. n. (2) — *Van Dillewijn:* 175 (2); 183 (17) — *Docters van Leeuwen-Reijnvaan:* s. n. (17); 2529 (2β); 12264 (2β) — *Dorgelo:* S. 248 (2) — *Dumas:* 10 (16) — *Dunselman:* 166 (19)

Elbert: 52 (2); 982 (1); 996 (1); 3129 (17) — *Elmer:* 4546 (2); 6551 (2); 7465 (5); 7778 (22); 11539 (1); 11682 (1); 11684 (5); 12360 (10); 14086 (22) — *Endert:* 3682 (2); 4978 (10) — *Everett:* 35, see p. 471; 37 (22); 42 (2).

Falconer: s. n., see p. 419 — *F. M. S. Museum Herb.:* 12121 (13) — *Forbes:* 692 (17); 911 (10); 924 (17); 2054 (17); 3855 (2) — *Forestry Bureau:* 194 (10); 1716 (10); 2743 (16); 3854 (19); 4666 (2); 4673 (22); 6326 (16); 8987 (16); 9511 (23); 10829 (2); 10894 (17); 10895 (1); 14498 (2); 16738 (10); 18049 (5) — *Forest Department* Federated Malay States: 4159 (19); 7856 (17); 10937 (2); 13645 (2); 14979 (19); 15441 (19); 16568 (11); 22563 (2); 22565 (17); 28284 (2) — *Forest Department* (British North Borneo): 4055 (10); 4083 (16); 4146 (16).

Galoengi-Schnepper: 10 (1) — *Gibbs:* 5540 (3); 5985 (16) — *Gillespie:* 3712 (12) — *Gjellerup:* 1148 (2) — *Gordon Spare:* 959 (19) — *Grashoff:* 874 (11); 1030 (17ι); 1138 (11) — *Gründler:* 2266 (2); 4191 (2) — *Gusdorf:* 312 (10); 314 (17).

De Haan: 13 (17) — *Hallier:* 183 (1); 427 (2); 653 (2); B.-numbers: 231 (10); 458 (2); 559 (17); 720 (17η); 775 (5); 2373 (19β) — *Ham:* 49 (19) — *Hasskarl:* s.n. (10); s.n. (10); s.n. (17β); 377 (17) — *Haviland:* 1093 (23); 1094K (2γ); 1095 (2γ) — *Hellwig:* 651 (17) — *Holttum:* s.n. (2γ) — *Hoogerwerf:* 5 (17) — *Hooker & Thomson:* s.n., see p. 419 — *Houter:* 14 (2); 24 (17); 25 (17); 178 (17) — *Houtsoorten van den Gedeh:* 107 (1); 204 (10); 637 (1) — *Houtvester Sum. Oostkust:* 17 (1) — *How:* 72870 (1) — *Huitema:* 12 (19).

Iboet: 547 (2).

Jeswiet: 257 (2); field no. 289, herb. no. 1307 (10) — *Jeswiet & Hagedoorn:* 450 (2) — *Jochems:* 24 (2) — *Junghuhn:* s.n. (11 ×) (2); s.n. (5 ×) (2β); s.n. (3 ×) (10); s.n. (10 ×) (17).

Kelsall: 1094 (2); 2000 (17) — *Kings' collector:* s.n., see p. 419; 301, see p. 432 — *Kjellberg:* 3792 (2); 3973 (16) — *Kobus:* s.n. (2) — *De Kock:* 39 (8); 40 (8); 43 (8) — *Koens:* 183 (17).

Koorders:

Herbarium numbers, followed by β

1215 (17); 1216 (1); 1217 (1); 1218 (1); 1219 (1); 1220 (1); 1221 (1); 1222 (17); 1223 (17); 1224 (1); 1225 (1); 1226 (1); 1227 (1); 1228 (1); 1229 (17); 1230 (15); 1231 (1); 1232 (1); 1233 (1); 1234 (1); 1235 (1); 1236 (17ζ); 1237 (17ζ); 1238 (1); 1239 (1); 1240 (17); 1241 (1); 1242 (1); 1243 (17); 1244 (17); 1245 (1); 1246 (1); 1247 (1); 1248 (1); 1249 (17); 1250 (17β); 1251 (17); 1252 (17); 1253 (17); 1254 (17); 1255 (17); 1256 (17); 1257 (1); 1258 (17); 1259 (17); 1260 (17); 1261 (10); 1262 (10); 1263 (10); 1264 (10); 1265 (10); 1266 (10); 1267 (10); 1268 (10); 1269 (2); 1270 (2); 1271 (2); 1272 (2); 1273 (2); 1274 (2); 1275 (2); 1276 (2); 1277 (2); 1278 (2); 1279 (2); 1280 (2); 1281 (2); 1282 (2); 1283 (2); 1284 (2); 1285 (2); 1286 (2); 1287 (2); 1288 (2); 1289 (2); 1290 (2); 1291 (2); 1292 (2); 1293 (2); 1294 (2); 1295 (2); 1296 (2); 1297 (2); 1298 (2); 1299 (2); 10286 (10); 10287 (10); 10906 (2); 10944 (1); 11246 (2); 11247 (1); 11248 (17); 11282 (2); 11720 (17); 11908 (1); 11909 (10); 12581 (2); 12599 (2); 12607 (1); 12608 (2); 12618 (2); 12627 (17); 13847 (17); 13855 (1); 13892 (17); 13997 (17); 14025 (17); 14026 (1); 14066 (17); 14122 (2); 14141 (2); 14143 (1); 14144 (17); 14159 (2); 14185 (1); 14195 (1); 14200 (17); 14201 (1); 14202 (1); 14206 (17); 14321 (2); 14323 (2); 14326 (1); 14376 (1); 14377 (1); 14378 (1); 14379 (1); 14380 (1); 14381 (1); 14382 (1); 15534 (2); 15535 (2); 15544 (1); 15582 (2); 15748 (1); 15751 (1); 15752 (1); 16533 (17); 16534 (16); 16535 (16); 16536 (16); 16537 (16); 16538 (16); 21091 (17ζ); 21092 (1); 21093 (1); 23340 (1); 23733 (17); 24179 (17); 24180 (17); 24181 (10); 24182 (2); 25577 (1); 25599 (10); 25819 (2); 25922 (2); 26540 (17β); 26553 (17); 26560 (17); 26576 (1); 26785 (1); 27704 (2); 27705 (2); 28503 (1); 28505 (2); 28506 (1); 28507 (2); 28508 (1); 29187 (1); 29188 (2); 29189 (2); 32439 (1); 32478 (1); 32768 (10); 33207 (10); 33751 (17); 35781 (17); 35782 (2); 35935 (17); 37111 (2); 37922 (2); 37923 (2); 37924 (1); 37925 (17); 38187 (2); 38188 (2); 38189 (1); 38198 (17β); 38501 (17ζ); 38626 (2); 38650 (1); 38652 (2); 38669 (2); 38783 (1); 39352 (1); 39364 (2); 39366 (2); 39392 (1); 39401 (17); 39402 (10); 39403 (10); 39404 (10); 39405 (17); 39406 (10); 39407 (10); 39409 (10); 39413 (10); 39415 (10); 39480 (15); 39596 (10); 39599 (15); 39623 (1); 40251 (15); 41778 (17); 41790 (2); 41806 (1); 41820 (2);

41843 (2); 41921 (2); 41951 (2); 41972 (2); 41992 (17); 42038 (1); 44321 (2); 44322 (1); 44323 (17).

Forst or tree numbers:

followed by a:

2124 (1); 2135 (10); 2170 (2); 2195 (17); 2197 (1); 2212 (1); 2215 (1); 2216 (1); 2416 (1); 2438 (17); 2446 (10); 2501 (10); 2502 (10); 2503 (10); 2504 (10); 3031 (17); 3053 (2); 3073 (2); 3074 (1); 3090 (2); 3127 (2); 3233 (2); 3235 (1); 3276 (2); 3295 (2); 3305 (1); 3312 (2); 3342 (2); 3362 (17); 3408 (1); 3417 (2).

followed by aa:

2461 (1); 2430 (17); 2433 (1); 2442 (1); 2454 (1); 2500 (17).

followed by f:

2050 (2); 2099 (1); 2118 (1); 2120 (2); 2126 (2).

followed by i:

2268 (1); 2291 (1); 2380 (2); 2420 (17); 2423 (17); 2432 (1).

followed by t:

4016 (1); 4117 (1); 4178 (1); 4185 (1); 4202 (1); 9401 (2); 9408 (2); 9412 (2); 9426 (1); 9431 (2); 9432 (2).

followed by w:

4185 (17ζ).

followed by *:

20 (17); 50 (10); 51 (10); 99 (1); 295 (17β); 362 (2); 365 (1); 382 (17); 579 (17); 580 (1); 705 (2); 728 (2); 772 (16); 885 (2); 889 (1); 960 (16); 1097 (15); 1425 (16); 1439 (17); 1443 (17); 1480 (17); 1545 (17); 1863 (2); 1928 (1); 1929 (17β); 1933 (17); 1985 (2); 2019 (2); 2056 (2); 2078 (17); 2094 (1); 2305 (17); 2328 (2); 2396 (2); 2578 (2); 2679 (16); 2874 (16); 3243 (2); 3446 (1).

Koorders' Plantae Junghuhnianae ineditae: 55 (17) — *Korthals:* s.n. (2) (3 ×); s.n. (17) (3 ×) — *Krukoff:* 238 (10) — *Kuhl & van Hasselt:* s.n. (1); s.n. (1); s.n. (2).

Labohm: 1214 (19) — *Lam:* 1773 (8); 1789 (25); 2153 (3); 2154 (8); 2159 (3); 2160 (2); 2161 (10); 2163 (22) — *Lauterbach:* 2446 (16) — *Ledermann:* 7105 (17); 9027 (10); 9421 (1); 9878 (18); 9943 (18); 9996 (18); 11064a (18); 11399 (22); 11447 (22); 12755 (22); 13000 (1) — *Leefmans:* s.n. (2); 31 (2) — *Loher:* 7137 (5) — *Lorentz:* 1699 (3) — *Lörzing:* 868 (2); 6676 (2); 7117 (2); 7118 (17); 7119 (1); 7264 (17); 7336 (10); 8299 (2); 8627 (2); 8628 (10); 8936 (2) — *Van der Meer Mohr:* 9 (2) — *Merrill:* 241 (22); 1992 (17); 5268 (19) — *Miquel:* s.n. (10) — *De Monchy:* s.n. (2) — *Mousset:* 334 (2).

Native collector: s.n. (1); s.n. (17); 337 (17ζ) — *Naumann:* N.G. 43 (21).

Opziener Pengalengan: X (1); XIII (2).

Palmer & Bryant: 988 (2) — *Peekel:* 588 (2) — *Pella:* 55 (16) — *Perottet:* s.n. (17β) — *Posthumus:* 2188 (17); 3235 (2) — *Praetorius:* s.n. (16) — *Pringgo Atmodjo:* 82 (2); 90 p.p. (2); 526 (1) — *Pulle:* s.n. (2); s.n. (19); 964 (8); 965 (8); 1023 (25) — *Van der Pijl:* 229 (17).

Raap: 713 (2) — *de Raat:* s.n. (2) — *Ramli:* 2338 (19) — *Rant:* 732 (17) — *Rappard:* P. 19 (2); S. 28 (2) — *Reinwardt:* s.n. (1); s.n. (2); s.n. (17) (2 ×) — *Rensch:* 692 (2); 1162 (2); 1307 (2) — *Ridley:* s.n. (10); s.n. (19); s.n. (17) — 165 (19); 1441 (19); 3158 (17γ); 3367 (19); 3716 (2); 4823 (19); 4823b (19);

9422 (17); 10016 (17η); 11192 (17); 16024 (13) — *Robinson:* 309 (16) — *Roepke:* 4 (17) — *von Römer:* 736 (8); 746 (2); 751 (2); 1215 (8); 1230 (17); 1231 (8); 1237 (8); 1238 (8) — *Rutten:* 3 (17) — *Van Rijckevorsel:* 66 (2).

Sapei: 147 (2) — *Sapiin:* s.n. (2) (2 ×) — *Sarip:* 371 (2) — *Scheffer:* s.n. (2); s.n. (17) (4 ×); s.n. (17β) — *Schiffner:* 1473, 1474, 1475 (2) — *Schlechter:* 16790 (17); 17395 (10); 18780 (22); 18781 (22) — *Siegel:* s.n. (2) — *Singapore Field no.:* 853 (19); 7997 (13); 8420 (19); 8877 (17); 10720 (17η); 11471 (17); 17745 (17); 18606 (17); 18608 (2); 20333 (19); 21341 (11); 23931 (2); 26450 (24); 27010 (2); 27735 (2); 28052 (2γ) — *Van Slooten:* 471 (17); 748 (17) — *Smith & Rant:* 350 (2) — *Snepvangers:* s.n. (2) — *Soegandiredja:* 32 (17) — *Van Steenis:* 1882 (2); 3018 (17); 3179 (17ι); 3690 (17); 3695 (2); 3754 (10); 3755 (10); 3756 (17); 4127 (17); 4135 (2β) 4778 (2β); 6290 (2); 8357 p.p. (5); 8357 p.p. (2β); 8380 (2β); 8423 (2β); 8459 (2β); 8470 (17δ); 8986 (2β); 9127 (5); 9614 (17δ); 9642 (2β); 9649 (5); 9712 (2); 9957 (2); 10812 (2); 10844 (1).

Toxopeus: s.n. (1); 485 (2) — *Teysmann:* s.n. (10) (4 ×); s.n. (16) (5 ×); s.n. (17ϑ) (2 ×); s.n. (19) (6 ×); 513 H.B. (17ϑ); 517 H.B. (1); 518 H.B. (2); 3278 H.B. (10); 3505 H.B. (10); 5189 H.B. (10); 7815 (16); 8832 (16); 11358 (19β); 11359 (17); 11360 (19); 13984 (2); 13988 (2); 14068 (16); 14069 (1); 14121 (22); 14191 (22).

Uhl: 6592 (17); 6617 (17).

Vermeulen: 50 (2) — *Versteeg* 2436 (8); 2505 (25); 2537 (8) — *De Voogd:* 119 (2); 134 (2); 449 (10); 451 (10); 554 (17); 1494 (17); 1649 (1); 1844 (17); 2301 (17γ) — *De Vriese:* s.n. (2); s.n. (17); s.n. (16) — *De Vriese & Teysmann:* s.n.: (16); s.n. (17).

W.: s.n. (17) — *Waitz:* s.n. (2) — *Warburg:* 16433 (22); 16890 (22); 16891 (22); 21127 (17); 21128 (21) — *Weiss:* 3820 p.p. (2); 3820 p.p. (5) — *Whitford:* 951 (5) — *Winckel:* s.n. (2) (2 ×) — *Wind:* 6506 (1) — *Winkler:* 3057 (17) — *Wissel:* 154 (8); 161 (8) — *Wood:* 1244 (10) — *Wray & Robinson:* 5432 (13).

Yates: 1987 (2); 2148 (2); 2554 (10) — *Yoder:* s.n. (5).

Zippelius: s.n. (17); s.n. (21) — *Zollinger:* 2019 (17); 2229 (2); 2262 (2); 3025 (10) — *Zwart:* 6517 (2β).

Index to vernacular names

referring to the species by means of their serial number.

Remark: It is characteristic for the Malay and allied languages, that names as *kajoe tjina, kibima, pohon aroe* &c., in which the first part *kajoe, ki, pohon,* &c., means tree, are often abbreviated to *tjina, bima, aroe,* &c., whereas in other cases any name of a tree, not beginning with one of these words may be provided with it; in this way, *e.g., tjemara* becoming *kajoe tjemara,* &c. This has to be taken in consideration when consulting this index.

angin-angin 2.
antoh 17.
aroe(h) 2.
asoër 16.
assoijer 16.
bage 2.
bangkol 17ζ.
batang tada 19.
bawah (kajoe) 11.
beberas 17.
beboeloeh 1.
beling (ki) 17.
beroe 2.
biali 1.
bima (ki) 1, 2, 10, 17, 17β, 17ζ,
boeloeh (kajoe) 1, 10.
bokhaoe 1.
bulusoma 10.
china (kayu) 16.
damar (ki) 10.
damar laki (-laki) 10.
damar radja 10.
damar radja laki-laki 10.
demelai 10.
dewan doro 10.
dingali 17.
djamoedjoe 2, 2β.
djerret 10.
doke-doke 1.
dokeh-dokeh 7.
doke laki 1.
efroewetana 1.
emboen (kajoe) 2.
endjan 17.
hades (ki) 2.
hadji (ki) 2.
haoe loeganel 1.
haoe toeni 2.
hotang (kajoe) 17.
hroeh 2.
jamoedjoe 2.
jati 19.
jati laut 19.
kadje sanoedoene 17.
kadjoe, kajoe, kayoe, kayu: see the second word.
kalek koereseng 10.
kalek rotan 17ϑ.
karamat 19.
kasuari goenoeng 16.
kebal ajam 10, 11.
ki: see the second word.
laboe rimba 10.
lampega 17.
lanang (kajoe) 10.
lanang abang (kajoe) 10.
lemhan 10.
lewi kajoeang 17.
lilen, lilin (kajoe, ki) 1.
loeganel (haoe) 1.
madang soegi-soegi 17.
majangmekar 2.
malambik 16.
malela(h) (ki) 10.
malelo (ki) 10.
mamoeliti 16.
mangkeboel (kajoe) 10.
manoek koeboel 11.
manoelit 16.
marak (ki) 17.
marama 16.
marama rendaj 17.
marangang 17.
marimboe 11.
marisa (kajoe) 17.
maron 17.
mboe 2.
medang merah 1.
medang sepaling 10.
medang sepaling abang 10.
melel(l)a 10, 17.
memboeloe 10.
mentada 19.
mentadeh 19.
mentadeh darat 19β
mentebal 10.
merak (ki) 1, 2, 17.
merakan 15.

tjemoro belah 17.
tjemoro bini 2.
tjemoro godong 2.
tjemoro rante 2.
tjemoro tikoeng 1, 2.
tjemoro toekoeng 2.
tjempa(n)dak 1.
tjimba-tjimba 4.
tjina (kajoe) 10, 11, 16, 17, 17, 19.
tjina itam (kajoe) 10.
tjoemara 2.
toean (kajoe) 1.
toeni (haoe) 2.
tombolilato 10.
topangkei 17.
totokan 10.
towar 1.
winong 1.
woeloean 17.

Index to scientific names and synonyms.

Occasionally mentioned names have been omitted. Names accepted for the area are in **thick** types, synonyms in *italics*, new names and combinations are marked with an asterisk.

NOTES ON MALAY COMPOSITAE

by

JOSÉPHINE TH. KOSTER

(Rijksherbarium, Leiden)

(Issued September 10th, 1941).

In working up the materials of the genera *Anaphalis*, *Gnaphalium* and *Blumea* for Backer's "Flora van Java" some new species, varieties and forms have come to light. The results of this work can by far not be considered to be complete, as the great lot of specimens collected in Java belonging to the genera under consideration are preserved in the "Herbarium van 's Lands Plantentuin te Buitenzorg". Owing to the war these specimens were not available as yet. However, it may be useful to publish the novelties hitherto discovered.

INULEAE-GNAPHALINAE.

Many authors have indicated already that the genera *Anaphalis* DC. and *Gnaphalium* L. are difficult to be separated. Miquel (Fl. Ind. Bat. II, 1856, 90) reduced *Anaphalis* to a section of *Gnaphalium*, as he did with *Antennaria*. This should be reasonable, were there not still more genera very closely allied to *Gnaphalium* and hardly to be separated, e. g. *Helichrysum*. It is up to a monographer of the *Gnaphalinae*, which of the closely related genera have to be considered sections of *Gnaphalium* and which have to be kept separate. As to the Javanese species it seems possible, though not easy, to distinguish *Anaphalis* from *Gnaphalium*. The heads of *Gnaphalium* contain few bisexual disc-flowers and two to numerous rows of female ray-flowers. Bentham and Hooker (Gen. Plant. II, 1876, 303) call the "heads of *Anaphalis* subdioecious". Clarke (Comp. Ind., 1876, 101) indicated already that one can find in the same species plants with heads containing a great number of female ray-flowers and few bisexual disc-flowers, as well as plants with a smaller number of female ray-flowers and many bisexual disc-flowers. Boerlage (Fl. Ned. Ind. II, 1899, 193) found still more variation in the heads of *Anaphalis*. He stated bisexual disc-flowers with divided,

as well as such with undivided styles in variable numbers in various heads of one species. Like Bentham and Hooker he found, that the bisexual disc-flowers are not always sterile. Indeed the type-specimen of *Anaphalis longifolia* (Bl.) DC. (in the Rijksherbarium, Leiden) seems to have ripe achenes arisen from disc-flowers. Heads apparently do not vary as to the proportion of bisexual disc-flowers and female ray-flowers in one and the same plant. However, in various plants of the same species this proportion is often variable, e. g. from three bisexual disc-flowers and numerous female ray-flowers to bisexual disc-flowers only (but never female flowers only). Of the three species, widely distributed in Java, I found in:

Anaphalis javanica (Reinw.) Schultz-Bip. (of 53 specimens)
55 % with heads having only bisexual flowers,
45 % with heads having female ray-flowers and bisexual disc-flowers.

Anaphalis viscida (Bl.) DC. (of 30 specimens)
50 % with heads having only bisexual flowers,
50 % with heads having female ray-flowers and bisexual disc-flowers.

Anaphalis longifolia (Bl.) DC. (of 90 specimens)
5½ % with heads having only bisexual flowers,
5½ % with heads having very few female ray-flowers and numerous bisexual disc-flowers,
89 % with heads having numerous female ray-flowers and very few bisexual disc-flowers.

As to the Javanese species of *Anaphalis* a clear separation between two groups strikes the eye. On the one hand there are the closely allied *A. javanica* (Reinw.) Schultz-Bip. and *A. viscida* (Bl.) DC., on the other *A. longifolia* (Bl.) DC. and *A. maxima* (O. K.) Steen. Apart from a different proportion of the female and the bisexual flowers, the last group also lacks the characteristic broadened setae of the pappus of the bisexual flowers, though a slight broadening is to be seen. Koorders (Exc. Fl. Java III, 1912, 330, 331) placed the species of the last group, tending to *Gnaphalium*, into that genus, which, however, seems not justified because of the undeniably close affinity to *A. javanica*.

A new variety and new combinations.

Anaphalis viscida (Bl.) DC. f. **Horsfieldii** (Miq.) comb. nov.; *Gnaphalium viscida* var. *Horsfieldii* Miq., Fl. Ind. Bat. II, 1856, 94 — This form having leaves not so strongly involute at the margins and on greater distances than usual, is a parallel-form of *A. javanica* (Reinw.) Schultz-Bip. f. *Junghuhniana* (Miq.) Boerl., having the same characteristics.

Anaphalis longifolia (Bl.) DC. var. **lanigera** var. nov.; caulis et folia superne cinnamomeo-fulvide scabride glandulosi et, ut folia subtus, dense albide lanato-tomentosi.

JAVA: East-Java, G. Andjasmoro, summit, Oct. (*Winckel 547*, L.[1]), type); G. Panderman, summit, near Batoe, 2000 m alt., May (*Groenhart 229*, U.), ib., June (*van Leer s. n.*, L.).

Of the three specimens available there was one with one row of female ray-flowers and numerous bisexual disc-flowers and two with many rows of female ray-flowers and few bisexual disc-flowers.

var. **sindoroensis** (Hochreut.) comb. nov.; *Gnaphalium sindoroense* Hochreut. in Candollea V, 1931—1934, 312.

Gnaphalium luteo-album L. ssp. **affine** (Don) comb. nov.; *Gnaphalium affine* Don, Prod. Fl. Nepal., 1825, 173; *Gnaphalium gracile* Bl., Bijdr., 1825, 900, non H. B. K.; *Gnaphalium Javanum* DC., Prod. VI, 1837, 222; *Gnaphalium multiceps* Wall. ex DC., Prod., 1837, 222; *Gnaphalium gracillimum* Schultz-Bip.! (non Perrott.) in Zoll., Syst. Verz. Ind. Arch., 1854, 124; *Gnaphalium Reinwardtianum* Miq.!, Pl. Junghuhn., 1854, 503; *Gnaphalium luteo-album* var. *multiceps* Hook., Fl. Br. Ind. III, 1882, 288 — The area in Java adjoins that of *Gnaphalium luteo-album* L. ssp. *typicum*. *Gn. luteo-album* ssp. *affine* is to be found in East-Java and the Lesser Sunda Islands, furthermore in Australia, the Philippines, Taiwan, Japan, China, Indochina, Siam, Hongkong, India, *Gn. luteo-album* ssp. *typicum* occurs in West-Java, furthermore in Australia, New Guinea, the Philippines, Indochina, India, Madagascar, Mauritius, Africa, Europe. As a rule the European specimens of *Gn. luteo-album* ssp. *typicum* have bigger heads (4—4½ mm long) and pale green or pale brownish involucral scales, of which the outer ones are more or less broadly ovate. Most of the Asiatic and Australian specimens have smaller heads (3½—4 mm long) and darker brownish involucral scales, of which the outer ones are ovate. However, specimens of the latter description have been actually found in Europe, while in Java a few specimens with very pale involucral scales have been collected. Clarke (Comp. Ind., 1876, 114) found specimens with yellow, golden-yellow or pale yellow involucral scales in the Indian mountains, but with brown or reddish-brown involucral scales in the plains of the River Ganges and of Central India. Finding all kinds of transitions

[1]) L. means Leiden, Rijksherbarium; U. Utrecht, Botanisch Museum en Herbarium der Rijksuniversiteit; Bz. Herbarium en Museum voor de systematische Botanie van 's Lands Plantentuin, Buitenzorg; G. Geneva, Institut de Botanique.

between these extremes, he called all specimens *Gn. luteo-album* L. However, Hochreutiner mentions (in Candollea V, 1931—1934, 313), specimens with brown, as well as with golden-yellow involucral scales growing side by side. They appeared to him so much different, that he feeled inclined to distinguish two separate species. A sheet is to be found in the Rijksherbarium, Leiden, to which two plants with brownish and two with yellowish involucral scales from Australia, are attached, which were evidently growing on the same spot. It seems reasonable to consider both taxonomical units as two subspecies of one and the same species. They are to be distinguished by the size of the heads (of ssp. *typicum* 3½—4½ mm long, of ssp. *affine* 3—3½ mm long) and the colour of the involucral scales (of ssp. *typicum* more or less pale brownish, of ssp. *affine* citrine to golden yellow).

Inuleae-Plucheinae.

To *Blumea* DC. there belong species, which are well limited and characteristic, such as *Bl. riparia* (Bl.) DC. and *Bl. arfakiana* Martelli. However, species of which the specimens are by no means quite similar, but show more or less important differences, are more frequent in this genus. Often the differences are too trifling to distinguish a separate species. Thus, polymorphous species are inevitable, of which moreover the conception of various authors is different. Their diagnoses of one and the same species are often considerably unlike, one describing the receptacle to be glabrous, the other describing it to be hirsute, etc. Examples of such polymorphous species are: *Bl. Junghuhniana* (Miq.) Boerl., *Bl. lacera* (Burm.) DC. and especially *Bl. macrophylla* (Bl.) DC. They create the dilemma: which is to be considered as a separate species and which is a variety of the polymorphous species. Hooker (Fl. Br. Ind. III, 1882, 260) was of the opinion that this genus is very unsatisfactory and is difficult to be separated from *Laggera*. The achenes (which in other genera of the *Compositae* often form valuable characteristics) are more or less similar in the various species, the shape of the leaves, the pubescence, etc. vary in one and the same species. There is conformity among the authors about the opinion, that cultivation of these variable species will facilitate the discrimination of the taxonomical units. It is probable that hybrids occur (Mattf. in Engl., Bot. Jahrb. 62, 1928, 420). *Bl. intermedia* nov. spec. makes the impression to be intermediary between *Bl. riparia* (Bl.) DC. and *Bl. lacera* (Burm.) DC. Specimens with leaves and tomentum like *Bl. mollis* (Don) Merrill and with inflorescences and heads like *Bl. lacera* (Burm.) DC. var.

javanica (Bl.) nov. comb., which have been found in the Malay Archipelago (*Waitz s. n.*, L.; Java, Buitenzorg, Oct., *coll. Hort. Bog.*, L.) may be hybrids of these two. Specimens apparently belonging to *Blumea bullata* nom. nov., but with subglabrous receptacles (Java, Kletak, 1500 m alt., *Mousset 856*, L.; Tjibodas, *Sapiin 229*, U., *2166*, U.) might be hybrids between this species and *Bl. macrophylla* (Bl.) DC.

New species, varieties, forms and combinations.

Blumea intermedia spec. nov. (Fig. 1—2).

Herbacea, plus quam 40 cm alta (fragmen); caulis teres minute

Fig. 1 — *Blumea intermedia* spec. nov., receptacle, × 3.

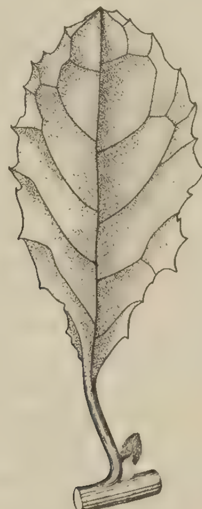

Fig. 2 — *Blumea intermedia* spec. nov., leaf, nat. size.

glandulosus, parte superiore griseo-villosa, 4 mm diametro. Folia superiora alterna (1—2 cm distantia) sessilia spathulato-elliptica, apice obtusa, basi gradatim attenuata, irregulariter repande dentata (dentibus late trangularibus, crassis, 3—11 mm distantibus) pinninervia (nervis utrinque 4—6) chartacea, supra scabra, infra adpresse griseo-villosa, 4—7 cm longa, 1½—3 cm lata, in axillis alabastris pallide brunneo-villosis; folia inflorescentiae minora acuta, etiam supra breviter villosa, ± 2 cm longa, 7—10 mm lata. Capitula longiuscule paniculata (panicula terminalis 10 cm lata, 20 cm longa) pedunculata (pedunculus 1½—

2½ cm longus, ½ mm diametro cum ramis inflorescentiae pallide brunneo-villosus) campanulata, 1 cm longa; involucrum campanulatum, 6-seriatum, squamis linearibus, exterioribus dense adpresse griseo-villosis, interioribus apicis margine pilosis, parte centrali angusta glandulosa villosa, omnibus acutis, ± ½ mm latis. Flores disci bisexuales ± 12; corolla tubuloso-infundibularis, 5 mm longa, lobis 5 brevibus glabris; antherae basi sagittatae, appendicibus basalibus filiformibus, longiusculis inter se connexis, apice subrotundatae; styli ramuli breves obtusi e corolla exserti; achenium cylindricum, 5-costatum, apice parce pilosum eiusque margine brevissime fimbriatum, 1 mm longum; pappo uni-seriato, setis albis scabris, corollam longitudine aequantibus, caducis. Flores radii

Fig. 3 — *Blumea pachycephala* spec. nov., head, × 3.

feminei numerosi; corolla filiformis, lobis 3 brevissimis; styli ramuli obtusi e corolla exserti; achenium et pappus achenio et pappo in floribus bisexualibus similes. Receptaculum alveolatum, pilis sparsis albis, ½ mm longis, deinde caducis contectum.

Bl. lacera (Burm.) DC. differs from the present species by the glabrous receptacle and by the shape of the leaves. The inflorescence and the receptacle of *Bl. intermedia* agree with those of *Bl. riparia* (Bl.) DC. The anthers were badly developed.

S u m a t r a: Krakatau, Verlaten Eiland, May, *Backer s. n.* (L., type); J a v a: Baros, near Soekaboemi, *Boerlage s. n.* (L.).

Blumea pachycephala spec. nov. (Fig. 3).

Herbacea, grandis, plus quam 1 m alta (fragmen); caulis teres

costatus glaber obscure purpureo-brunneus (siccus), 8 mm diametro. Folia alterna (6—8 cm distantia) subsessilia (petiolus brevissimus, 3 mm longus), anguste oblonga longissima subintegra (dentibus brevissimis, callosis) apice longe acuta, basi attenuata, 3—4 cm lata, 18—26 cm longa, chartacea pinninervia (nervis utrinque ± 15, nervis reticulatis infra prominentibus), supra obscura verrucoso-scabra bullata, infra pallida, parce breviter pilosa. Capitula paniculata (panicula magna laxa terminalis, 50 cm longa, 15 cm lata), pedunculata (pedunculus ½—1½ cm longus, parce breviter pilosus, glandulosus, interdum bracteis minutis, 3 mm longis, praeditus) cylindrica crassa multiflora, 10—12 mm longa, 8—10 mm diametro; involucrum subcampanulatum capitulo breviore, 8—10 mm longum; squamis interioribus linearibus, exterioribus lanceolato-ellipticis, obscuris, omnibus apice longe acutis, subglabris, parce adpresse pilosis, apicis margine pilosis, parte centrali obscura angustissima. Flores disci bisexuales ± 12; corolla anguste infundibularis, basi tumida, 7—8 mm longa, lobis 5 triangularibus acutis glandulosis, apice pilis nonnullis longis praeditis; antherae basi sagittatae, appendicibus basalibus filiformibus, inter se connexae, apice subrotundatae, e corolla exsertae; styli ramuli breves obtusi, e corolla longe exserti; achenium oblongum costatum pilosum (iuvenile); pappo uni-seriato, setis sordide albis scabris corollam longitudine fere aequantibus. Flores radii feminei numerosi; corolla filiformis, 6½ mm longa, lobis 3—4 longiusculis angustis subobtusis; styli ramuli subacuti e corolla longe exserti; achenium et pappus achenio et pappo in floribus bisexualibus similes. Receptaculum alveolatum glabrum.

Allied to *Bl. macrophylla* (Bl.) DC., but different by the heads, the leaves and the almost glabrous stem.

J a v a: Soerabaia, G. Andjasmoro, Aug., *Radermacher s.n.* (L., type).

Blumea acutata DC. var. **floresiana** (Schultz-Bip.) comb. nov.; *Conyza floresiana* Schultz-Bip.! in Zoll., Syst. Verz. Ind. Arch., 1854, 121; *Blumea floresiana* Boerl., Fl. Ned. Ind. II, 1899, 239.

Blumea macrophylla (Bl.) DC. var. **sylvatica** (Bl.) comb. nov.; *Conyza sylvatica* Bl.!, Bijdr., 1825, 898; *Blumea sylvatica* DC., Prod. V, 1836, 447.

Blumea lacera (Burm.) DC. var. **javanica** (Bl.) comb. nov.; *Conyza javanica* Bl.!, Bijdr., 1825, 897; *Conyza lacera* Bl.! Bijdr., 1825, 897; *Erigeron javanicum* Bl.! in herb. Blume 1861; *Blumea lacera* var. *Blumei* DC.! in Wight, Contrib. Bot. Ind., 1834, 14; DC., Prod. V, 1836, 436; *Blumea lacera* var. *Burmanni* DC., Prod. V, 1836, 436, non DC. in

Wight, Contrib. Bot. Ind., 1834, 14; *Blumea javanica* Zoll. in Flora N. R. V, 1847, 531.

var. **meraukensis** var. nov.; *Blumea lacera* Lauterbach in Nova Guinea VIII, II, 1910, 336; Mattfeld in Engl., Bot. Jahrb. 62, 1928, 420 p.p. — Caulis et folia parce pilosi. Folia spathulata, grosse dentata (dentibus late triangularibus mucronatis), apice subrotundata. Paniculae elongatae laxae; capitula parva, ± 6 mm longa et diametro.

New Guinea: South West Part, Merauke, alang alang field, Oct., *Versteeg 1844* (L., type; U.); Merauke, *Koch s. n.* (L.). Flowers yellow.

var. **microcephala** var. nov. — Caulis, folia, squamae involucri parce pilosi. Capitula parva, 5 mm longa; corolla 3½ mm longa, achenium ½ mm longum.

Sumatra: West Coast, G. Singgalang, feet, Aneh-cleft, shrubby, 360 m alt., July, *Schiffner 2750* (L., type).

var. **amboinensis** var. nov. — Folia spathulata, dentata (dentibus parvis, ± ½ mm longis); paniculae pauciflorae laxae; capitula parva, 6—7 mm longa.

Amboina, July—Nov., *C. B. Robinson 415* (L., type); Amboina, Sept., *Zippelius s. n.* (L.), leaves elongated, to 20 cm long; Amboina, *coll. unknown* (L.).

Blumea bullata nomen novum; *Conyza chinensis* Bl.!, Bijdr., 1825, 898; cum var. *poliolepis* Miq.!, Pl. Junghuhn. 1854, 500; Fl. Bat. II, 1856, 52, non Linn.; *Blumea chinensis* DC., Prod. V, 1836, 444, quoad descriptionem — This species cannot be the same as *Conyza chinensis* L., Sp. Pl. ed. 2, 1763, 1208, as was supposed by Blume, De Candolle and Miquel. Its leaves can hardly be called "subtus tomentosis", being sparsely hirsute beneath especially on the nerves and its heads are not "terminalibus congestis", but the inflorescences are small, loose axillary and terminal panicles, together forming a large leafy terminal panicle. Neither can the remark "raro plures quam tres flores simul congesti" concern the Malaysian species. Linné's species was described from China, whereas the present species occurs in Java. It is a pity, that the war prevents comparing Linné's original specimen.

Blumea humifusa (Miq.) Clarke, var. **monochasialis** var. nov. — Folia inferiora raro breviter petiolata (petiolus ± ½ cm longus) basi breviter attenuata. Capitula monochasialia.

Java: Semarang, Koedoes, *coll. unknown 45* (L., type), ? Java, *Blume 1995*, sub nomine "*Conyza javanica?*" (L.); Timor, herb. *Praetorius* (L.).

Blumea riparia (Bl.) DC. f. **angustifolia** forma nova. — Folia superiora oblongo-lanceolata ad lanceolata, basi breviter acuta, apice longissime acutata, 6½—12 cm longa, 1—3 cm lata.

Sumatra: West Coast, G. Koerintji, 2000 m alt., May, *Bünnemeyer 10329* (L., type, U.); G. Merapi, 900 m alt., Sept., *Bünnemeyer 4837* (L.); ib., 1150 m alt., Sept., *Bünnemeyer 4918* (L.); Benkoelen, Enggano, South coast, beach to the South of Boea Boea, June, *Lütjeharms 4208* (L.), non-flowering; Bangka, Mintok, forests, Oct., *Amand s.n.* (U.).

Java: West Java, G. Malabar, 1400—1600 m alt., July, *Denker 104* (L.); G. Tankoeban Prahoe, 600 m alt., *Junghuhn s. n.* (U.); Tjibodas, *Sapiin 2103* (L.); G. Papandajan, *Went s. n.* (L.); Semarang, Kedoengdjati, April, *Koorders 21501* (L.); Java, *Junghuhn 50* (L.), *s. n.* (L.).

Borneo: Br. N. Borneo, G. Kinabaloe, 1200 m alt., Tenompok, bridle trail, Dec., *Clemens 51063* (L.); Dallas, 900 m alt., Dec., *Clemens 27559* (L.); Peniboekan, 1200—1500 m alt., Febr., *Clemens 31556* (L.); Tawao, Elphinstone Prov., Oct-March, *Elmer 20500* (L., U.).

Celebes: Salajar, shrubby, ± 350 m alt., May, *Docters van Leeuwen 1707* (U.); Boeton, South East Lipoemangan, in a low forest, 250—320 m alt., Aug., *Elbert 2721* (L.).

Distribution: Taiwan, the Philippines, Sikkim.

VERNONIEAE-VERNONINAE (cf. Blumea I, 1935, 369—456).

Vernonia arborea Ham. var. **papanensis** Koster.

Riouw Arch.: P. Karimoen, Sebele-Poelau-Belat, along the edge of a forest on a swampy soil, 6 m alt., Aug., *Zwart 16* (Bz.). Flowers pinkish yellowish white; tree 28, 70 m high, 33—46 cm thick. The inflorescence of this specimen is not conspicuously corymbose, as it is in the type, but corymbosely paniculate.

Vernonia Junghuhniana Koster.

Java: Soerabaia, near Grisee, Sekapoeh, *Dorgelo 3015* (L.); near Grisee, Soetje, *Dorgelo s. n.* (L.); near Grisee, *Backer 37537* (L.); Bawean, *Dorgelo 136* (L.).

A new locality is added to the area known.

Vernonia Elmeri Merrill.

Soela Islands: P. Mangoli, Woetadontaka, *Exp. v. Hulstijn 220* (L.).

The area as far as known at this time, is extended to the East approaching that of the closely related *V. lanceolata.*

Vernonia lanceolata (Warbg.) Mattf.

Celebes: Manado, G. Klabat, forest in an open place on a stony and sandy soil, rare, scattered, 2000 m alt., Jan., *Steup 173* (Bz.). Flowers purplish blue.

This specimen, a fairly bad one, is slightly different from those collected up to this time, having mucronate involucral scales. Its habitat extends the area of this species as far as known at this time to the West.

Vernonia laxiflora Less.

Lesser Sunda Islands: Bali, near Batoe-lake, 1100—1400 m, lava-rocks, steep earth walls, etc., common, *van Steenis 7950* (Bz.), herbs 7—26 cm high, leaves crowded at the base; Bangli, wall of a temple, 500 m alt., *van Steenis 7980a* (Bz.); N.W. Tedjagoela, grassy and other fields, common, 100 m alt., *van Steenis 7737* (Bz.).

This *Vernonia* was only collected twice in Bali up to this time.

Vernonia coerulea Koster var. **glabrata** Koster.

Lesser Sunda Islands: Flores, alang alang field, Jan., *de Voogd s. n.* (Bz.).

This variety had been collected before in Soemba only.

Vernonia cymosa Bl. var. **Teysmanniana** (Miq.) Koster.

Java: East Java, Dorowati, *Dorgelo s. n.* (L.).

Vernonia cymosa Bl. var. **tengerensis** (Hochreut.) comb. nov.; *Vernonia eupatorioides* var. *tengerensis* Hochreutiner in Candollea V, 1931—1934, 297.

Shrubby, to 4 m high (fide Hochreutiner), strongly villous; hairs spreading, crisped, striate. Heads large, 7—8 mm long, ± 25-flowered; involucre 5½ mm long, purplish; corolla 5—6 mm long, broad.

Java: East Java, G. Tengger, *Hochreutiner 2738* (G.), *Went s. n.* (L.), *Schimper s. n.* (L.); ib., Tosari, *van Dillewijn s. n.* (L.); ib., Ajag Ajag, *Gisius s. n.* (L.); ib., Ngadisari, *Koorders 37427* (L.); Idjen, Pantjoer-Idjen, *Koorders 28532* (L.); Kawah-Idjen, *Koorders 43351* (L.); G. Ardjoeno, above Tretès, *Backer 3721* (L.); in Casuarina-forests, 2000—2700 m alt., Jan.-Febr., July-Sept. Flowers violet (fide Hochreutiner).

Eupatorieae-Ageratinae (cf. Blumea I, 1935, 483—510).

Eupatorium nodiflorum Wall.

Lesser Sunda Islands: Bali, alang alang field, Jan., *de Voogd s. n.* (Bz.), leaves broader, 5-nerved, up to 2 cm; Soemba, West,

in grassy places, common, 400 m alt., July, *de Voogd 1821* (Bz.), to 1 m high. Flowers pale violet.

This species, which had been collected only once before in the Malay Archipelago, viz. in Lombok, is difficult to be separated from specimens of *E. japonicum* Thunb. with simple leaves. However, the leaves of *E. japonicum* are longer petiolate and membranous, whereas those of *E. nodiflorum* are subsessile and subcoriaceous. It still has to be decided, whether *E. japonicum* Thunb., *E. cannabinum L.* and *E. nodiflorum* Wall. are not three subspecies of one polymorphous species.

Eupatorium odoratum L., which is indigenous in tropical America, has now been collected in Sumatra, Medan, *van der Meer Mohr* s. n. (Bz.).

THE IDENTITY OF ANTHERICUM ROUWENORTII DE GORTER (LILIACEAE)

by

S. J. VAN OOSTSTROOM

(Rijksherbarium, Leiden)

(Issued September 10th, 1941).

Anthericum Rouwenortii De Gorter, a species not occurring in the Index Kewensis, was described by De Gorter in his Catalogus Plantarum Horti Ulenpassiani, 1783, p. 51 and 52 as follows:

p. 51: ANTHERICUM.

2. Rouwenortii. foliis planis carinatis, scapo ramoso, corollis patentibus. *Tab.* I. Habitat in Zeylona?

Planta e seminibus e Zeylona, si bene meminit Ill. Baro De ROUWENOORT missis, ante multos annos enata colitur adhuc in Caldario Horti Uilenpassiani, ubi quotannis floret.

Descriptio.

Radix crassa, tuberosa, subtranslucida.

Folia radicalia, ensiformia, carinata, glabra, sesquipedalia, extremitate subulata.

p. 52: *Scapus* ramosus, fere tripedalis, ramis alternis, inferioribus brevioribus, superioribus longioribus. *Bracteis* lanceolato-subulatis bifidis. *Pedunculis* simplicibus.

Flores magnitudine *Antherici ramosi*, albi, apicibus petalorum viridibus. *Filamenta* alba, laevia. *Antherae* flavae. *Stylus* staminibus longior.

The Catalogus Plantarum Horti Ulenpassiani is a catalogue of plants cultivated in the gardens and greenhouses of Ulenpas, the estate of H. A. W. Baron van Rouwenoort and situated near Hummelo in the Netherlands' province of Gelderland. It contains lists of plant-names and the only species of which a description and a plate are given is the above mentioned *Anthericum Rouwenortii.*

The type of this species bearing the name *Anthericum Rouwenortianum* and a description of the living plant in De Gorter's handwriting is preserved in the collections of the Rijksherbarium at Leiden. It was discovered recently by the present author in the herbarium of David de Gorter, formerly professor of medicine and botany at the university of Harderwijk, Gelderland. This herbarium which had been totally lost

sight of for many years belonged to the museum of the "Vereeniging tot Beoefening van Overijsselsch Regt en Geschiedenis", at Zwolle, Gelderland, and was ceded to the Rijksherbarium some months ago.[1])

From an examination of the type, in which I was kindly assisted by Mr. A. Meeuse, it resulted that this is fully identic with *Chlorophytum elatum* (Ait.) R. Br., a species of South African origin and not occurring in Ceylon. It is consequently obvious that the statement "habitat in Zeylona" mentioned by De Gorter must be wrong. De Gorter himself evidently suspected this already, as appears from the addition of an interrogation-mark after "Zeylona" in the original description and from the words "planta e seminibus e Zeylona, si bene meminit Ill. Baro De Rouwenoort missis".

We now come to the question whether the name *Chlorophytum elatum* (Ait.) R. Br. as used by South African botanists is the correct one for this species.

Anthericum elatum Ait. on which *Chlorophytum elatum* has been based was described by Aiton in his Hortus Kewensis I, 1789, p. 448 with the words:

A. foliis planis, scapo ramoso, pedunculis aggregatis, corollis planis.
Asphodelus foliis planis, caule ramoso, floribus sparsis. *Mill. ic.* 38, *t.* 56.
Tall Anthericum.
Nat. of the Cape of Good Hope.
Introd. 1751, by Mr. Philip Miller. *Mill. ic. loc. cit.*
Fl. August and September. G. H.[2]) ♃

The combination *Chlorophytum elatum* always has been attributed to Robert Brown (R. Br., Prodr. Fl. Nov. Holl., 1810, p. 277) but this author did not use that name. He only says that *Anthericum elatum* and an other species of *Anthericum* from the Cape belong to the genus *Chlorophytum* ("Huc Anthericum elatum *Hort. Kew.* et altera species capensis nondum descripta"). As far as I could check the name *Chlorophytum elatum* has been used for the first time by Sprengel (Sprengel, Syst. II, 1825, p. 88). Sprengel adds R. Br. as the author's name. From this it follows that the right name for our plant is *Chlorophytum elatum* (Ait.) R. Br. ex Spreng. according to Art. 48 of the International Rules of Botanical Nomenclature.

However, in the 10th edition of Linnaeus's Systema Naturae (L.,

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[1]) For a life history of professor David de Gorter and for a description of his herbarium see my paper in the 51st volume of the Nederlandsch Kruidkundig Archief issued by the Nederlandsche Botanische Vereeniging (Netherlands Botanical Society).

[2]) greenhouse.

Syst. Nat., ed. 10, 1759, p. 982) we find the name *Asphodelus capensis* L., accompanied by the words "A. scapo nudo ramoso, fol. lanceolatis planis. *Mill. ic.* 56" [1]). This is the same plate which Aiton mentions when describing his *Anthericum elatum* and as it seems to be the whole basis of the species of Linnaeus it is clear that *Asphodelus capensis* L. and *Anthericum elatum* Ait. (= *Chlorophytum elatum* (Ait.) R. Br. ex Spreng.) are identic. The specific epithet *capensis* being older than *elatum*, the correct name in the genus *Chlorophytum* must be *Chlorophytum capense*, a combination made already by Otto Kuntze.

The synonymy of *Chlorophytum capense* (L.) O. K. now becomes as follows:

Chlorophytum capense (L.) O. K., Rev. Gen. Plant. III, 2 (1898) p. 316.

Asphodelus capensis L., Syst. Nat., ed. 10 (1759) p. 982, non Burm. f. (1768).

Anthericum Rouwenortii De Gorter, Cat. Plant. Hort. Ulenpass. (1783) p. 51, t. 1.

Anthericum elatum Ait., Hort. Kew. I (1789) p. 448.

Chlorophytum elatum (Ait.) R. Br. ex Spreng., Syst. II (1835) p. 88.

Phalangium elatum (Ait.) Poir., Encycl. V (1804) p. 248.

Phalangium fastigiatum Poir., Encycl. V (1804) p. 246.

Phalangium fasciculatum Baker, non Poir., in Journ. Linn. Soc. XV (1876) p. 331.

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[1]) Dr. D. Mac Gillavry, Bergen, was so kind as to provide me with this description.

NOTES ON THE NOMENCLATURE OF SOME GRASSES
II

by

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(Issued September 10th, 1941).

In a former article [1]) many new combinations and critical observations were published on various grasses all over the world. New investigations in critical genera together with the study of the existing literature made it necessary to accept various other arrangements in this important family. The old system of Bentham, once the basis for a total review, is now more and more modified and many tribes are purified and more exactly limited. The most recent system we have at the moment, is Hubbard's treatment of this family in the work of Hutchinson: The families of flowering plants. Vol. II. Monocotyledons. The grasses are divided there into 26 tribes. We have here the great advantage that aberrant genera, which are not easy to place into one of the formerly accepted tribes, are given as representatives of distinct new tribes. The curious tropical genus *Streptochaeta* f. i. constitutes the tribe of the *Streptochaeteae*. It is quite acceptable that tribes may consist of but one genus, especially when such a genus is a totally deviating one and cannot be inserted into one of the already existing ones. Such tribes are f. i. the *Nardeae* with the only northern genus *Nardus*, and the Mediterranean tribe of the *Lygeeae* with the only genus *Lygeum*, one of the Esparto grasses. It is therefore no wonder that Hubbard creates a new tribe, the *Anomochloeae*, for one of the most curious tropical grasses of the world. This tribe is represented by only one species, the *Anomochloa marantoidea* Brongn., with a very curious habit and no evident affinities with any other grass. The same can be said of the aberrant genus *Pariana*, the only member of the tribe of the *Parianeae*. The most valuable advance is the creation

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[1]) Blumea III, Nr. 3, 1940, 411—480.

by Hubbard of the tribe of the *Thysanolaeneae* with as the only member our well-known tropical and subtropical East-Asiatic genus *Thysanolaena.*

Although this new subdivision of the family of the grasses gives us a great satisfaction, it does not mean that the system is complete and certainly many changes are to be given before we will have a totally correct and acceptable classification of the grasses.

One of the very good ideas in Hubbard's work is the purified tribe of the *Chlorideae*, that mixtum of genera formerly thrown together on account of apparent agreements in the structure of the inflorescences. Such well-known former members of the *Chlorideae* as *Eleusine, Dactyloctenium* and *Leptochloa*, are now transferred to the *Eragrosteae* and at the same time the tribe of the *Festuceae* is purified, although the latter is at the moment not yet quite sharply limited.

This tribe of the *Festuceae* has in the future to be reorganized, as is proposed by the Russian taxonomist Nevski. I think that too little attention is given to Nevski's ideas, although they are very good and quite in accordance with my own investigations.

The subtribe of the *Melicinae* of Hubbard becomes therefore a tribe, the *Meliceae*, not only with the genus *Melica*, but including 4 other genera, *Glyceria, Pleuropogon, Schizachne* and *Anthochloa.* This is a more natural arrangement, very acceptable to all agrostologists familiar with those genera.

The remaining *Festuceae* are now to divide into the actual *Festuceae* and the *Bromeae*, the latter is thus a distinct, equivalent tribe, having a distinct relationship to the *Aveneae.* The many reasons for such an opposition are given in extenso by Nevski. The new tribe of Nevski's *Bromeae* has various members, f. i. the genera *Boissiera* and *Littledalea* and especially the genus *Bromus* in the sense as it is developed, since it was created in the year 1753. If we study this genus in the broad sense, as found in nearly all our manuals, it is always very striking that it is so enormously heterogeneous and consists of the most different elements. It is therefore easily understood that many taxonomists were not content with such a monstruous genus and since Linné described the genus *Bromus*, his successors have now and then given names to groups and proposed such groups as genera. Stapf gave in recent times a very critical review of the whole genus *Bromus* in Kew Bulletin (1928) p. 209.

As to the actual genus *Bromus* we can neglect the Linnean ideas on the genus given in 1737 in the Flora lapponica, as our starting point is Linné's Spec. Plant. ed. 1, 1753. Here the first described

species is *Bromus secalinus* L. and in the modern typification of the genera this species is accepted as the type of the genus *Bromus*. This gives us at the same time the satisfaction that a great many species of the genus can without any difficulty be placed in this restricted genus *Bromus*. The taxonomic characters of the annual *Bromus secalinus* L. agree with many other annual species of *Bromus* such as *Bromus arvensis* L., *B. brizaeformis* F. et Mey., *B. hordeaceus* L., *B. mollis* L., *B. racemosus* L., *B. commutatus* Schrad., *B. squarrosus* L., *B. japonicus* Thunb., *B. scoparius* L., *B. macrostachys* Desf. and others. At the same time it is consequently necessary to accept the characteristic deviating species as not belonging to this genus *Bromus* s. strict. *Littledalea* Hemsl. is thus not a *Bromus* at all, it has pilose lodiculae and lemmata up to 3 times longer than the paleae and many other deviating taxonomic characters; moreover, the species of this genus are perennials. For the same reasons we cannot insert *Bromus unioloides* H. B. K. in our purified genus *Bromus*, but we accept for it Beauvois's genus *Ceratochloa*, with **C. cathartica** (Vahl) Henr. nov. comb. as type, based on *Bromus catharticus* Vahl. As is known this genus is characterized by the complicate-keeled glumes and lemmata and the deeply furrowed ventral side of the caryopsis. The perennial species formerly placed in the genus *Bromus* are to accept as a distinct genus. Such species are f. i. *Bromus erectus* Huds. and *B. ramosus* Huds. in Europe. They were formerly accepted as a distinct section *Festucaria*. As a genus it was, however, published by Panzer in Denkschr. Ak. München, 1813, p. 296. The type species is to be accepted as *Zerna aspera* Panz. Panzer's figure agrees with this genus *Zerna*. *Bromus asper* Murr. is the perennial species already known as *Bromus ramosus* Huds. (1762). We have thus in the Netherlands 4 species of the genus *Zerna*: *Z. erecta* (Huds.) Panz., *Z. ramosa* (Huds.) Nevski, *Z. Benekeni* (Lge.) Lindm. and *Z. inermis* (Leyss.) Lindm.

In the Asiatic region we have the *Bromus Richardsonii* Link, which becomes *Zerna Richardsonii* (Link) Nevski and a great many other species already treated by Nevski. In Java we have but one species accepted by me as **Zerna insignis** (Buse) Henrard nov. comb. based on *Bromus insignis* Buse. The above mentioned *Bromus Richardsonii* Link is according to American botanists only a form of the widely distributed *Bromus ciliatus* L. The latter is **Zerna ciliata** (L.) Henr. Other species are **Zerna purgans** (L.) Henr. nov. comb. based on *Bromus purgans* L.; **Zerna vulgaris** (Hook.) Henr. nov. comb. based on *Bromus vulgaris* (Hook.) Shear; **Zerna latiglumis** (Shear) Henr. nov. comb.

based on *Bromus purgans latiglumis* Shear, and **Zerna anomala** (Rupr.) Henr. nov. comb. based on *Bromus anomalus* Rupr. ap. Fourn. Mex. Pl. II, p. 126. Allied to the European *Zerna ramosa* (Huds.) Nevski is the Himalayan **Zerna himalaica** (Stapf) Henr. nov. comb. based on *Bromus himalaicus* Stapf. **Zerna Mairei** (Hack.) Henr. nov. comb. is based on *Bromus Mairei* Hack.

On account of the *Bromus ramosus* Hudson described in 1762 the *Bromus ramosus* L. from the year 1767 must have another name. This *Bromus ramosus* L. is a *Brachypodium* and was placed by Roemer and Schultes in 1817 under *Brachypodium ramosum* (L.) R. et S. This is only correct, if there is before the year 1817 no other valid name. In 1798 there was, however, described a *Festuca caespitosa* Desf. Fl. Atl. p. 91, which is Roemer and Schultes's species. Hence we have to make the new combination **Brachypodium caespitosum** (Desf.) Henr. based on *Festuca caespitosa* Desf.

If we combine this species with the *Brachypodium phoenicoides* R. et S. (1817) accepted by Roemer and Schultes as distinct from their *Brachypodium ramosum*, it is evident that *Brachypodium phoenicoides* has priority, because it is based on *Festuca phoenicoides* L. Mantissa. I (1767) p. 33.

The conclusion in this case is that a valid name of a plant depends in many cases on the rank that we attribute to it. We are not yet at the end of our contemplations on the *Bromeae*, because a very natural group of *Bromi* is grouped around the *Bromus sterilis* L. This group is characterized and differentiated from the actual genus *Bromus* by the unequal glumes, the lower 1-nerved, the upper 3-nerved and by the cuneate spikelets, when they are mature. This group, to which belong further our well-known *Bromus tectorum*, *B. madritensis* L., *B. rubens* L., *B. fasciculatus* Presl. and *B. rigens* L., must, accepted as a genus, bear the name of *Anisantha* Koch. All the species are transferred by Nevski to that genus. For reasons of priority he could not accept the *Bromus villosus* Forsk. (1775) non Scop. (1772) or *Bromus maximus* Desf. (1798). Generally *Bromus rigidus* Roth (1790) is accepted as the valid name for this species. Nevski used the name *Bromus rigens* L. (Mantissa, 1767) making the combination in *Anisantha*; at the same time he accepts the *Bromus Gussonii* Parl. as specifically distinct from *Bromus rigidus* Roth.

His critical treatment of this *Bromus Gussonii* is directed against Cugnac and Camus's supposition that this plant should be a hybrid between *B. rigidus* and *B. sterilis*.

Camus and Cugnac based their ideas of the supposed hybrid on the morphological characters, which seem, as they accept, to be deviated from the supposed parents *B. sterilis* and *B. rigidus*, and secondly on the geographical distribution. As to the morphological characters it is evident that these not always indicate a hybridisation especially as the length of the glumes and lemmata of the supposed hybrid are in accordance with *Bromus rigidus* and do not indicate an influence of *B. sterilis*. As to the geographical distribution we agree that this gives us in many cases very important deductions. But in such a case we must know the whole area of the two species and of the supposed hybrid.

Bromus rigens (rigidus) is a species of a more western distribution in the Mediterranean region and is not known from Asia Minor, the Crimea and the Caucasus, where it is replaced by *B. Gussonii*. It is therefore more probable that *B. Gussonii* is the eastern, *B. rigens* the western species and that there, where the two areas overlap, we may find hybridisation. *Bromus rigens*, occurring only in N. Africa and Southern Europe, cannot be one of the parents of *Bromus Gussonii*, as the former does not occur in the large eastern area, where *B. Gussonii* is common. Nevski is thus quite justified in accepting *Bromus Gussonii* as a non-hybrid plant and takes it as a distinct species. Having more sharply limited the genera we have treated here, there remain now a few aberrant species. These are not to incorporate into one of the genera mentioned above and ought to be treated separately.

First of all the very characteristic *Bromus Trinii* Desv. described in Gay, Flora Chil. (1853) p. 441. This species is unique among the *Bromi* by the awn, which is an arista perfecta, consisting of a twisted column and a geniculate subula. Moreover, this species has very minute lodiculae only. By these characters we have, morphologically speaking, a very near relationship with the tribe of the *Aveneae* and especially with the genus *Trisetum* (compare also the caryopsis "villous at the apex"). It was therefore very natural that the great Russian agrostologist Trinius described the same species as *Trisetum hirtum* Trin. in Linnaea X (1835). This is the valid name. It is the only species in the new genus *Trisetobromus* Nevski. We are quite satisfied that such a characteristic and deviating plant of the tribe of the *Bromeae* is placed in a distinct genus, which is at the same time quite in accordance with its curious neogaean distribution.

There remain now but two aberrant grasses of the tribe, e. g. *Bromus gracillimus* Bunge and *Bromus arduennensis*. They are consequently

accepted by Nevski as belonging to two distinct genera. For *B. arduennensis* the genus *Michelaria* Dumort. (1823) is accepted. This genus is certainly much allied to the actual genus *Bromus*. The *Bromus gracillimus* is an Asiatic species with minute 4—5-flowered spikelets, the lemmata are only 4—4½ mm long and the smallest in the tribe. It is an annual plant and so deviating that a new genus for such a plant is justified. This was created by the Russian botanists Kreczetowicz and Vvedensky, who named this genus *Nevskiella* with the only species *N. gracillima* (Bge) K. et Vved. The great advantage of such a division of the tribe of the *Bromeae* is that the genus *Bromus* as accepted by Nevski is not only sharply limited, but at the same time the various species of this genus are better to be classified. We know that Holmberg has given one of the best classifications of this genus in the year 1924. Nevski has proposed some alterations in this group, which make it simpler and more surveyable.

We learned thus in the group mentioned above, how important it is to limit the various genera properly. Only in such a case should monographical studies be prepared. A monographical study of the genus *Koeleria* as given in the magnificent work of Domin (Bibl. Botanica 1907) is from the beginning already denunciated, because that author did not realize the differences between the allied genera in this group. Many species of *Koeleria* in Domin's work are simply species of *Trisetum*, f. i. nearly all his species of the *Dorsoaristatae* Dom. *Koeleria*, as it is accepted by Domin, is an unnatural complex of annual and perennial species. *Trisetum* and *Koeleria*, of course, are much allied, there exist even hybrids between them, but quite as in *Lolium* and *Festuca* this is no reason to unite such genera. A more natural arrangement is therefore that *Trisetum* consists only of perennial species and quite the same can be said of the actual genus *Koeleria*. The annual species of *Koeleria* represent the genus *Lophochloa* Reichb. f. and the annual *Trisetum*-species belong to the genus *Trisetaria* Forsk. In the genus *Koeleria* one of the most common and most distributed species bears in our manuals still a wrong name, because Domin did not accept it. But Domin's arguments are not correct and against the principles of taxonomy and nomenclature. The correct name for this grass is *Koeleria cristata* (L.) Persoon.

The type of *Bromus japonicus* Thunb. was a plant with glabrous spikelets. A rather common form is a variety with densely villous or pubescent spikelets, which was named by Ascherson and Graebner var. *velutinus*, based upon *Bromus velutinus* Nocc. et Balb. (1816). There

was, however, already a *Bromus velutinus* Schrader (1806), which belongs to *Bromus secalinus.* Stapf recognized this already and accepted for this variety the name *vestitus* based upon *Bromus vestitus* Schrader (1821). Stapf's variety was, however, given under *Bromus patulus* M. et Koch, which is a synonym of Thunberg's species. Placing Schrader's *Bromus vestitus* under *Bromus japonicus* the correct name of the variety becomes **Bromus japonicus** Thunb. var. **vestitus** (Schrad.) Henrard nov. comb. The name *Chiapporianus* De Not. ap. Parlatore given in 1848 and accepted by Penzes is invalid.

The genus *Lasiochloa* was published by Kunth in the second volume of his Révision des Graminées in the year 1829, where 3 species are given with very long descriptions and plates with analyses. After the first species *Lasiochloa ciliaris* (Thunb.) Kunth, based upon *Dactylis ciliaris* Thunberg, the genus is characterized on p. 556 and diagnosed versus *Dactylis.* This is a valid publication of a genus, although Kunth described it once more in 1833 in his Enumeratio.

Unfortunately Kunth examined only a specimen in the Berlin Herbarium bearing the name *Dactylis ciliaris* Thunb., which was not the type of Thunberg. The real type of *Dactylis ciliaris* Thunb. is a totally different plant and belongs to the genus *Brizopyrum*, compare Stapf in Flora Capensis p. 703. Kunth's *Lasiochloa ciliaris* based on the *Dactylis ciliaris* Thunb., but described and figured as a totally different species of *Lasiochloa*, must bear another name in that genus. This *Lasiochloa* is at the same time Thunberg's *Alopecurus echinatus*; the new combination **Lasiochloa echinata** (Thunb.) Henr. is here proposed for the only annual species of this genus.

Panicum oligotrichum was published by Figari and De Notaris in Memorie della Reale Accademia delle Scienze di Torino, Ser. II, Tom. XIV, in an article Agrostographiae aegypticae fragmenta. Pars. II. Graminia Aegypti et Nubiae (exhib. 26 decembris 1852), p. 333, plate X (with analysis). This species is moreover = *Helopus bolbodes* Steudel (1854) = *Panicum bolbodes* (Steud.) Schweinf. = *Urochloa bolbodes* (Steud.) Stapf. The volume XIV of the Memorie, mentioned above, bears on the title page the year 1854, but in reality the various papers were issued already in the foregoing years and the name *Panicum oligotrichum* has therefore priority.

Steudel's Synopsis bears on the title page 1855, but the first part was published in Jan. 1854. In this part *Helopus bolbodes* was published. I therefore wish to make the new combination **Urochloa oligotricha** (Fig. et De Not.) Henr. based upon Figari and De Notaris's species.

Brachiaria paspaloides (Presl) Hubbard var. **tomentosa** Henr. nov. var. — differt a typo praesertim vaginis foliisque dense molliterque villosis, pilis sericeis appressis vel erecto-patentibus; spiculae ut in typo glabrae.

Samoa Islands: Upolu, Mulifanuaküste, III. 1894 leg. Dr. Reinecke no. 265. Typus in H. L. B. sub no. 908, 92 — 1628.

This plant was named *Panicum prostratum* Lamk. The typical *Brachiaria paspaloides* which was formerly better known as *Panicum ambiguum* Trin. is more glabrous, commonly the sheats are hairy only along the margins or slightly so on the summit, and the blades are glabrous or very sparsely hairy only. In the variety all the vegetative parts with exception of the internodes are densely tomentose.

There occurs in the New World a characteristic group of perennial species, which is accepted by Hitchcock and Chase in their study on the North American species of Panicum as the group of the "*diffusa*". This group is also represented in South America and in the tropics of the Old World. Their members are not only characterized as perennials, but they all have a very effuse panicle and a densely compact growth.

Members of this group are *Panicum campestre* Nees, *Panicum Bergii* Arechav., *P. pilcomayense* Hack., *P. quadriglume* (Doell) Hitchc., *P. Ghiesbrechtii* Fourn. and a new one, I will describe here.

Panicum diffusum Sw. from the West Indies is the typical species of this group.

The various species mentioned here are often confounded in collections and it is not so easy to separate them. *Panicum campestre* Nees f. i. was given by Balansa as an inhabitant of Indo China. Specimens mentioned by him and seen by me belong, however, to *Panicum trypheron* Schultes, a species given as an annual plant by Hooker and afterwards by Camus, but it is certainly a perennial, as noted by Hitchcock and verified by me. *Panicum trypheron* is the Old World member of the group with glabrous nodes and glabrous internodes, but with solitary panicle branches and it is therefore quite distinct from all the other members of the „*diffusa*". To recognize the species of this group we must at first indicate some characters of the panicle. Various species have panicle branches always placed singly along the rhachis and the lower branches of a panicle are not longer than the other ones, so that the panicle is ovoid or oblong in outline. At the same time the axils of the panicle branches are naked, thus devoid of long white hairs. These characters are to be found f. i. in *Panicum diffusum, P. quadriglume* and *P. Ghiesbrechtii.* Other species have verticillate

panicle branches, i.e. more than one on each node of the rhachis, the lower ones are nearly as long as the whole panicle and the form of the latter thus becomes much broader than long, whereas the axils are often provided with a beard of long white hairs. To this group belong *Panicum campestre* and *P. Bergii*, and also the *Panicum pilcomayense*, although this character in the latter is not so striking as in the other two species. Hackel's *Panicum pilcomayense* has, moreover, glabrous nodes, the West Indian *Panicum diffusum* with solitary panicle branches has appressedly pubescent nodes only, the hairs very short. The type of *Panicum pilcomayense*, formerly seen by me, is nearly glabrous throughout and misidentified by Hitchcock, who mentions it from British Guiana as collected by Schomburgk. Schomburgk's number 656 is a very hirsute plant with bearded axils of panicle branches and hirsute internodes and belongs to *Panicum campestre* Nees. Hackel and Lindman described a var. *leiophyllum* of *Panicum Bergii*. Lindman gave a good description and a beautiful plate. From this description and the plate the plant is easily recognizable by its solitary panicle branches with glabrous axils and its long bearded ring just above the nodes, the hairs longer than the diameter of the nodes. It is impossible to bring this interesting variety in connection with *Panicum Bergii*, which is at once to distinguish by the very different form of the panicle with bearded axils and by the very long narrowly inrolled leaves. This variety proved to be identical with a new species I had among Balansa's grasses of Paraguay. It is also much allied to *Panicum quadriglume* Hitchc., which is very curious by its two sterile lemmata. *Panicum quadriglume* is probably a teratological species, with its two sterile lemmata, the spikelets thus consist of 4 outer scales and a hermaphrodite flower, whereas there are in *Panicum* as delimited at present, but 3 outer scales, the fourth scale in *Panicum quadriglume* is quite the same as glume III and not a palea of a second flower. If we have here a teratological case, the species without this 4th scale ought to exist and must then unfortunately bear the name of *Panicum quadriglume*. It had been better, if Hitchcock had given another name to the variety *quadriglume* of Doell, when he gave it specific rank. I am therefore obliged to describe Balansa's plant as a new species under the name of

Panicum peladoense Henr. as follows: Perennis, caespitosa; culmi glaberrimi, nodis paucis; pars inferior nodorum glabra, leviter inflata, pars superior corona pilorum praedita; laminae lineares, sensim in apicem angustatae, inferiores 10—15 cm longae, 3—4 mm latae, superiores 7—

8 cm longae, glabrae sed basi pilis paucis longis margine ciliatae; vaginae pilis sparsis, marginibus ciliolatae, ligula perbrevis, minute ciliolata; panicula exserta, ad 10 cm longa, 5 –8 cm lata, ramis solitariis, planiusculis, ramulis capillaceis angulatis, scabriusculis, in axillis glabris; spiculae 3 mm longae, sparsae, flavidae vel superne coloratae, lanceolatae vel obovato-lanceolatae, acuminatae, ad maturitatem compressae et hiantes, gluma inferior spiculae circa medium aequans vel paulo superans, 5-nervis, gluma secunda et lemma sterilis ovato-oblongae, plurinerves, lemma fertilis elliptica vel obovato-elliptica, 2 mm circa longa, laevissima, nitidissima, badio-nigra.

PARAGUAY: Cerro-Pelado, prope Paraguari, 3 avril 1883, leg. B. Balansa no. 4357. Typus speciei in Herb. Lugd. Bat. sub no. 908, 93—2087.

Other specimens belonging to this new species are:

PARAGUAY: Pentes rocailleuses et herbeuses du Cerro-Peron près de Paraguari, 29 Oct. 1876, leg. B. Balansa no. 14. This is a very fine specimen, perfectly agreeing with the type.

ARGENTINA: Posadas, Gobernación de Misiones, elemento de las praderas virgines, 4 Feb. 1922, leg. L. R. Parodi no. 4513. These are more depauperate specimens with spikelets only up to 2.8 mm long.

BOLIVIA: Cuesta de los Monos, 1400 m, III. 1911, leg. Th. Herzog no. 1896 j. Formerly mentioned by me in my work on the Bolivian grasses, collected by Herzog as *Panicum Bergii* Arechav. var. *leiophyllum* Hack. and Lindman, which is, as already indicated, conspecific with my new species. These specimens agree with Parodi no. 4513 in having spikelets a trifle smaller than in the type.

Nees described in the year 1829 from Brazil a *Panicum capillare* (Agrost. brasil. p. 198) collected by Sellow at Montevideo. Nees said that his plant was a perennial. A duplicate of this plant in our Herbarium is indeed a perennial plant and belongs to *Panicum Ghiesbrechtii* Fourn., having yellow fruits, the blades are smaller and narrower than commonly is the case, the spikelets are, however, 3 mm long.

The Old World species *Panicum trypheron* Schultes belongs as to the characters of the panicle branches and the glabrous axils in the neighbourhood of this *P. Ghiesbrechtii* and also to *P. peladoense*. The synonyms of *Panicum trypheron* are as follows: *Panicum trypheron* Schultes Syst. Veg. Mantissa Vol. II (1824) p. 244!, based upon *Panicum tenellum* Roxb. Fl. Ind. ed. Carr. et Wall. I (1820) no. 41, p. 306. The name changed by Schultes on account of the earlier *Panicum tenellum* Lmk. *Panicum Roxburghii* Sprengel Syst. I (1825) p. 320 is based

upon the same *Panicum tenellum* Roxb. *Panicum trypheron* is at once to distinguish from *Panicum campestre* by its solitary branches of the panicle and by its glabrous nodes. It was often identified with the annual *Panicum psilopodium* Trin. The character annual versus perennial in this group is very important for the identification of various species of *Panicum*, as was demonstrated by Hitchcock and Chase.

Key to the species of the group of the diffusa.

1a. Second glume and sterile lemma not elongated, only slightly longer than the fruit 2
b. Second glume and sterile lemma elongated, at least three times as long as the fruit . . . . **P. capillarioides** Vasey
2a. Spikelets less than 4 mm long 3
b. Spikelets long, at least 4 mm long or even longer . . . . **P. lepidulum** Hitchc. et Ch.
3a. Blades not over 1 cm wide, or mostly narrower; plants not so very robust; panicle diffuse and open 4
b. Blades 2 cm or more wide, plant very robust, panicle narrow and compact . . . . **P. hirsutum** Sw.
4a. Lower panicle-branches geminate or verticillate, the lower ones nearly as long as the whole panicle, the latter thus nearly as long as broad . . 5
b. Panicle-branches solitary, or if sometimes with an additional second branch, always much shorter than the whole panicle, the latter thus ovate-oblong in outline, axils of branches always glabrous or with a minute very short pubescence 7
5a. Axils of panicle-branches with a tuft of long white hairs, the upper ones sometimes glabrescent, nodes bearded, plants very hirsute 6
b. Axils of panicle-branches glabrous, no long white hairs, nodes glabrous, plant nearly glabrous throughout . . . . . . **P. pilcomayense** Hack.
6a. Blades narrow, inrolled or at least with inrolled margins, rather long . . . . **P. Bergii** Arechav.
b. Blades broader, quite flat, internodes, sheaths and peduncles very hirsute by tubercle-based hairs . . . . **P. campestre** Nees
7a. Nodes adpressedly pubescent or bearded with spreading hairs . . . 8
b. Nodes quite glabrous, panicles rather long with distant ascending branches . . . . **P. trypheron** Schultes
8a. Nodes densely hirsute or with a ring of hairs longer than the diameter of the node 9
b. Nodes adpressed-pubescent only, the hairs very short 11
9a. Spikelets with 2 sterile lemmata . . . . . . **P. quadriglume** Hitchc.
b. Spikelets with only 1 sterile lemma 10
10a. Blades very hirsute, nodes bearded or hirsute all over, fertile lemma yellowish . . . . **P. Ghiesbrechtii** Fourn.
b. Blades very sparingly hirsute or with some long hairs only along the margins, fertile lemma dark brown at maturity . . . . **P. peladoense** Henr.

11a. Plants erect, blades broader than 3 mm, mostly up to 5 mm wide, plants very glaucous 12
b. Plants spreading or ascending, blades very narrow, filiform or up to 3 mm wide, plants not glaucous . . . . **P. diffusum** Sw.
12a. Spikelets 3—3½ mm long, rarely longer, blades shorter than the plants, panicles much exceeding the leaves . . . . **P. Hallii** Vasey
b. Spikelets 2—2.6 mm long, blades as long as the plant or longer, panicles usually exceeded by the uppermost blade . . . . . **P. filipes** Scribn.

Another very difficult genus is *Axonopus*. In the course of a preparation of a monographical work on *Digitaria*, I had also to identify Sprengel's *Digitaria aurea*, which belongs, however, to the allied genus *Axonopus*, as it is understood in modern times. The name *aureus* goes back to Beauvois and since *Axonopus aureus* was mentioned by him in the year 1812, there is an enormous contradiction in the literature as to what plant Beauvois had in mind. Beauvois himself was not quite sure of his new genus *Axonopus*, being as we know in reality a mixture of various things. In recent times, *Milium compressum* Sw. being accepted as the type of the genus *Axonopus*, the question is settled. In Beauvois's work we find a note by him, telling us that through the generosity of Mr de Lessert, he received a plant, which ought to belong to his genus *Axonopus*. This *Axonopus aureus* Beauv. is accepted by American agrostologists as published and they identify this plant with the plant figured by Trinius in his Icones in the year 1828. There are now two objections against this American concept of the plant of Beauvois.

The type of Beauvois is lost, a specimen so named by him could not be found in the Delessert Herbarium. Moreover, we cannot accept that *Axonopus aureus* Beauv. was validly published, because no botanical description was given in the year 1812. Chase noted that the author's observation, that the spikelets are provided below with an involucre of short golden hairs, points conclusively to one of the species with a cluster of golden hairs subtending the spikelets and she adds that following Trinius in his Icones, the common species with the smaller and glabrous spikelets is taken as the true *Axonopus aureus* Beauv.

This method propagated by the American author is quite arbitrary, as in absence of a type specimen, the informal observation of Beauvois points to a number of species, each having such a cluster of golden hairs, subtending the spikelets. It is therefore impossible to recognize Beauvois's plant and the name is nothing else but a nomen nudum. If we describe a plant, we have to give at least a few characters, no

general observations are to be mentioned, which apply to all the members of a group.

The question became more difficult, because in the year 1815 in the Nova Genera by Humboldt, Bonpland and Kunth a *Paspalum aureum* was described. A very good and accurate description was given and a plate from which this *Paspalum aureum* it at once recognizable as an *Axonopus* with golden hairs and spikelets sunken into hollows of the rhachis and at the same time it is the species accepted by Chase as *Axonopus chrysoblepharis* (Lagasca) Chase. Unfortunately the authors of the Nova Genera mentioned *Axonopus* (misspelled *Axinopus*) *aureus* Beauv. as a synonym and therefore Chase accepted that *Paspalum aureum* H. B. K. was based on *Axonopus aureus* Beauv. I do not agree with this opinion. Years ago I had a discussion on the same subject with Prof. Hackel, who refused to accept the point of view of American authors on the same reasons, because in the Nova Genera the name *Axinopus aureus* Beauv. is given accidentally, because it was found in the literature, and being a nomen ambiguum could not have been the basis of the *Paspalum aureum*. It was thus not a transfer by Humboldt, Bonpland and Kunth, although they had better done to omit this name of Beauvois. Whatever it may be, *Paspalum aureum* H. B. K., exactly described and figured, is the first valid publication of a member of the genus *Axonopus* with golden hairs, a publication of the year 1815, which, transmitted to the genus *Axonopus* becomes *Axonopus aureus* (H. B. K.) Beauv. ap. Roem. et Schult. Syst. Veg. II (1817) p. 318. *Digitaria aurea* Sprengel Syst. I (1825) p. 272 is based on *Paspalum aureum* H. B. K. and belongs thus to the true *Axonopus aureus* (H. B. K.) Beauv. as accepted by Roemer and Schultes.

It may be once more strongly emphasized that in such cases of nomenclature a transfer to another genus goes only with the oldest name, if this name is validly published; if it is a nomen nudum or ambiguum, however, it must be neglected. If *Axonopus aureus* Beauv. had been described in reality in 1812 and had been recognized from an existing type, a later combination *Axonopus aureus* (H. B. K.) Beauv. ap. R. et Schult. would have been of course invalid.

There is, however, another difficulty as to these species of *Axonopus* with golden hairs. *Paspalum aureum* H. B. K. is accepted as a perennial species, but there exists a different annual, although allied species, which was already mentioned in 1917 as *Axonopus appendiculatus* Hitchcock based on *Paspalum appendiculatum* Presl. We find this plant in Hitchcock's work on the Grasses of West India. Hitchcock probably saw

Presl's type and indicates it as an annual, although Presl gives it as a perennial. Hitchcock overlooked the *Paspalum immersum* Nees published a year earlier. This *Paspalum immersum* is given by Chase as a synonym under *Axonopus chrysoblepharis* (Lag.) Chase, which is accepted as a perennial species. The type of Nees was formerly examined by Chase, but nothing is said by her about its basal parts.

The description by Nees, however, is very clear and he says that it is an annual plant. All the other characters given by Nees apply to the annual plant. Nees himself gave to his *Paspalus immersus* formerly in herbaria the name of *Paspalus exasperatus*, but what he described and published in the year 1829 as *Paspalus exasperatus* is another species and different from his annual *Paspalus immersus*.

The annual *Axonopus* allied to *A. aureus* (H. B. K.) Beauv. with spikelets sunken into the rhachis has been named *Axonopus immersus* (Nees) Kuhlm. This name is more correct, because it is based upon an earlier name. We must, however, call attention to the fact that the true *Paspalus immersus* Nees was already known to Trinius, who described the *Paspalum excavatum* Nees in Mart. Fl. Bras. ined. in the year 1826 in his Dissertatio botanica altera on p. 88. That this is a species of *Axonopus* with spikelets sunken into the rhachis is proved by his data: "spiculis minimis in scrobiculis biserialibus". The "folia lineari-lanceolata, spithamaea, margine hirtula" point to the annual plant. We do not know, why Nees afterwards gave it another name, when he published in 1829 his Agr. Brasil. *Paspalum excavatum* Nees ap. Trinius is, however, the same as *P. immersus* Nees from 1829, and has priority above Nees's *P. immersum*. This is proved by Trinius's own statement in 1834 in his Panicearum Genera p. 197, where he treated *Paspalum immersum* N. ab Es. Agr. bras. p. 82 with a point of exclamation giving *Paspalum excavatum* Trin. Dis. II p. 88 as a synonym. We do not know what were the reasons of Trinius and Nees to change the names. I therefore prefer to accept the annual species as **Axonopus excavatus** (Nees) Henr. nov. comb. based on the species as described already in 1826.

There is another annual very beautiful species, where the spikelets are not sunken into the rhachis. It was described by Trinius as *Paspalum holochrysum*, upon which the new combination **Axonopus holochrysus** (Trin.) Henr. is based.

All other members of the section *Cabrera* are perennials. A beautiful species with white hairs instead of golden ones is **Axonopus canescens** (Doell) Henr. nov. comb. from Guiana, based on *Paspalum senescens* Doell.

A species intermediate between the section *Cabrera* with long golden, yellowish or white hairs and the *Axonopus*-group proper is *Paspalum suffultum* Mikan, upon which the new combination **Axonopus suffultus** (Mikan) Henr. is based. At the moment many species of *Axonopus* without hairs below the spikelets are not yet fully known and a monographical work on this difficult genus ought to be prepared on the type basis method. I saw various types of *Paspalum*, which belong to the genus *Axonopus*. These specimens are mentioned here as follows: **Axonopus flexilis** (Mez) Henr. nov. comb. based on Mez's type of *Paspalum flexile* (Ule 8020); **Axonopus caulescens** (Mez) Henr. nov. comb. — *Paspalum caulescens* Mez (type Ule 8533); **Axonopus Fockei** (Mez) Henr. nov. comb. based on *Paspalum Fockei* Mez from Guiana. The type is Focke (without number), which I did not see. Ule no. 8022 belongs, however, to this species with its very characteristic summit of the blades, its flabellate growth and its many racemes. Curious are the blades, which are quasi articulate with the sheaths and the ceriferous white indumentum of the lower parts of the plant. **Axonopus iridaceus** (Mez) Henr. based on *Paspalum iridaceum* is a species allied to *Axonopus suffultus* (Mikan) Henr. having short hairs below the spikelets.

A beautiful *Axonopus* with golden hairs was mentioned by Doell as var. *pilosum* under *Paspalum immersum* Nees. The type is Burchell no. 6875—2. This is a perennial plant with characteristic innovations and belongs thus to Humboldt's *Pasp. aureum*. It is named here by me **Axonopus aureus** (H. B. K.) Beauv. var. **pilosus** (Doell) Henr. nov. comb.

The genus *Otachyrium* was described by Nees in 1829 with but one species *O. junceum* Nees. This plant was already known to Trinius, who described it as *Panicum Pterygodium*, mentioned by Nees with the name of Trin. in Monogr. ined. Trinius described his species, however, already in Dissertatio II (1826) p. 227. Being transferred to the genus *Otachyrium* its name is therefore *O. Pterygodium* (Trin.) Pilger with *O. junceum* Nees as a synonym. It is very curious that Nees did not recognize that in the same year he described also a *Panicum truncatum*, which as to its striking characters evidently belongs to his genus *Otachyrium*. Now that the genus *Otachyrium* is distinguished as distinct from *Panicum*, we have to accept *Panicum truncatum* Nees as a member of the genus *Otachyrium*. *Panicum truncatum* Nees is, however, invalid on account of the earlier *Panicum truncatum* Trin. from the year 1826 and figured by Trinius afterwards in 1829 in the Icones II. pl. 168. This is the well-known *Panicum geminatum* Forsk. Doell was thus quite justified

to give another name to the species of Nees. He named it *Panicum versicolor* Doell. Hence the correct name under *Otachyrium* becomes **Otachyrium versicolor** (Doell) Henr. nov. comb.

In *Paspalum*, more sharply defined, since Chase worked out her beautiful treatment of this genus, there are still a great many difficulties as to the valid names we have to accept. Parodi's *Paspalum epilis* (sic) described in Physis is invalid, because there was already a *Paspalum* so named earlier by Nash. Parodi's species is allied to *Paspalum planum* Hackel. I had a specimen received from Parodi under the name of *Paspalum epilis* L. R. Parodi nov. spec. tipo! from Santa Inés-Posadas (Misionis). For this species I propose the name **Paspalum Parodianum** Henr. nom. nov. based upon *P. epile* Parodi non Nash.

A few other *Paspali* are described here for the incorporation in our collections as follows:

Paspalum limbatum Henr. nov. spec.

Perennis, caespitosa, stricte erecta; culmi simplices, paucinodes, glabri ut tota planta, nodis nigricantibus; folia basalia cum vaginis saltem ad 15 cm longa, caulina ad 10 cm longa, 2 mm lata, plana, sensim acuminata, ligula fuscata, glabra, brevis; inflorescentia exserta, racemi in apice culmi 3—5, alterni, basi in axillis barbata, ceterum glabra, inferiores circa 3 cm longi, superiores decrescentes, circa 1 cm longi, spiculae obovatae vel obovato-ellipticae, glabrae, 1.5—1.7 mm longae, antice planae, postice gibbo-convexae, brunneae, gluma superior spicula paullo brevior, convexa circa 3—5-nervis, nervis pallidioribus, margini valde approximatis, gluma sterilis (III) spiculam magnitudine et forma aequans, plana, brunnea, marginibus latiuscule subincrassato-limbata, limbo flavido, interne minute crenulato; gluma IV (fertilis) convexa, gibba, fusca nitida vel minute punctulata.

PARAGUAY: Villa Rica, in campis humidis, 10. X. 1874. leg. B. Balansa no. 107. Typus speciei in H. L. B. sub no. 908,93—1213.

Belonging to Chase's group of the *Plicatula* with dark olivaceous spikelets and dark brown shining fruits, this new *Paspalum* is at once distinguishable from other members of the group by its very small spikelets, short racemes and marginated flat glume III, the paler rather broad and slightly thickened margins sharply contrasting with the brownish other part of the glume. It may be that this species is to be found among the different varieties mentioned by Doell under *Paspalum plicatulum* Michx., although Doell gives the length of the spikelets as sublineales vel lineales vel plus minus ultra-sesquilineales, the spikelets are in *Paspalum limbatum*, however, still much smaller.

Another allied species is described by Nees as *Paspalum riparium* and mentioned by Doell as an annual species with spikelets, which do not reach a line. Doell says even: *fortasse Paspali plicatuli varietas microcarpa.* This *Paspalum riparium* being an annual species should not be brought into connection with our new species. Our new species is most related to *Paspalum centrale* Chase from Central America, compare the figure 133 in Chase's work, but the spikelets are longer (2–2.3 mm) and devoid of the thickened margins of the flat glume.

The other extreme of *Paspalum plicatulum* with the very large spikelets on long racemes is *Paspalum guenoarum* Arechavaleta. From this species I saw a beautiful form, which I mention here as

Paspalum guenoarum Arechav. var. **vestitum** Henr. nov. var. Differt a typo praesertim vaginis, foliisque omnino dense hirsuto-pilosis, pilis saepe adpressis.

Paraguay: Guarapi, in pratis, feb. 1881, leg. B. Balansa n. 2950. Typus in H. L. B. sub no. 908, 93—423.

Paspalum eburneum Henr. nov. spec. — Perennis, subcaespitosa, et ut videtur, breviter stolonifera; culmi stricte erecti, elongati, simplices, glaberrimi ut fere tota planta, nodis paucis distantibus, cum inflorescentia circa ¾ m alti, pro ratione plantae graciles; laminae longissimae, saltem ad 20 cm longae, complicatae, vi expansae vix 3 mm latae, sensim setaceo-acuminatae, supra praesertim inferne longe villosae, ore barbatae; inflorescentia longe exserta, e spicis 2 conjugatis composita, interdum spicae 3 adsunt, quorum una breviter pedunculata, basi pilis albis instructae, racemi erecto-patuli, 7—8 cm longi, rhachi undulata, depresso-trigona, anguste marginata; spiculae biseriales, subimbricatae, breviter pedicellatae, glabrae, eburneae, ovato-oblongae, acutae, 2—2.2 mm longae, antice planae, postice convexae, glumae II en III aequales, spiculam magnitudine et forma aequantes, gluma III plana, 3-nervis, nervis margini valde approximatis, gluma II convexa, 5-nervis, nervis lateralibus sibi valde approximatis, gluma IV fertilis flavida, sublaevis vix nitida.

Paraguay: Villa Rica, Oct. 1874. leg. B. Balansa no. 75. Typus in H. L. B. sub no. 908, 93—278.

Also in Brazil near Pará, Marajo Island, open savannas, Estate "Cavinho" leg. André Gouldi, V. 1918 no. 182 (cotypus in H. L. B. sub no. 924,329—995 et 924,329—879).

This is a species of another difficult group, the "*notata*" consisting of perennial species, leafy only at the base, with conjugated racemes, mostly 2 (rarely a third one is present) and solitary spikelets. This group is represented in N. America by but a few species and Chase

observed already, when she treated the most common species *Paspalum notatum* Fluegge, that from the largest spikelets of this form to the smallest of *Paspalum minus* there is an almost unbroken series. In South America 4 more species occur and this group is here also a very difficult one. The new species proposed here by me is most allied to *Paspalum maculosum* Trin. described in the year 1826. Trinius mentioned already that his new species was allied to *P. notatum,* but easy to distinguish from that species by the narrow blades and the villous axils of the racemes. These characters occur also in *P. eburneum*, which is certainly most allied to *P. maculosum*, but the latter has reddish brown spikelets with yellowish spots.

Paspalum trichophyllum Henr. nov. spec. — Perennis, dense caespitosa, culmi erecti, ad ½ m alti, simplices, haud robusti, paucinodes, glaberrimi, nodis glabris nigricantibus; vaginae stramineo-fuscae, compressae, inferne villosae, superne glabrescentes, laminae angustissimae, filiformes, flaccidae vel flexuosae, involutae vel subplanae, sensim longe setaceo-acuminatae, vix 1 mm latae, cum vaginis ad 20 cm longae, superne decrescentes, glaberrimae, ligula abbreviata vix conspicua; inflorescentia exserta e racemis aequidistantibus circa 5 composita, axis communis filiformis, subplana vel subtrigona; racemi erecto-patuli, sessiles, a basi nudi, inferiores 2—2½ cm longi, superiores sensim decrescentes, 1—1½ cm longi, rhachi spiculis multo angustiore subtrigona glabra; spiculae brevissime pedicellatae, inordinate quadriseriales sed seriebus 2 intermediis plus minus confluentibus, glabrae, 2 mm longae, 1.2 mm latae, ellipticae, glumae apice rotundatae sed distincte, nervo mediano excurrente, acutatae, 3-nerves, virides, nervis margini valde approximatis, gluma IV fertilis pallida, obtusa, coriacea, convexa, punctis seriatis scaberula.

BRASILIA: Estado do Pará, Ilha de Marajó, Fazenda Gavinho, leg. André Gouldi, Jan. 1918, no. 165. Typus speciei in H. L. B. sub no. 924,321—190.

Belonging to the group of the "*livida*" as this is given by Chase, but which is scarcely a natural one, as she remarks. Its nearest allies are probably *Paspalum lividum* and *Paspalum denticulatum* both described by Trinius. The former is stouter, has much broader not filiform leaves, racemes with long delicate hairs in the axils, their rhachises are 1½—2 mm wide and the spikelets mostly larger. The latter is also more robust, according to the plate 123 by Trinius in the Icones it has about 10 racemes, broader leaves, broader rhachis of racemes and larger spikelets with distinctly denticulate margins of the glumes. Nearly all the species

of the group of the livida have racemes with long white hairs at the axils, with exception of *Paspalum denticulatum*. By these wanting hairs *Paspalum trichophyllum* agrees more with *Paspalum denticulatum*, from which it is, however, at once to distinguish by the quite different habit with the filiform blades.

Forskahl described a *Saccharum hirsutum*, which does not belong to this genus. Since it was described it was placed by taxonomists in various genera such as *Rottboellia*, *Ischaemum*, *Elionurus* and *Coelorhachis*, which proves how difficult it was to find its correct place among the *Andropogoneae*. It was therefore understandable that Boissier accepted this plant as a distinct new genus under the name of *Lasiurus*. This genus was accepted also by the modern agrostologists Stapf and Hubbard, because the plant cannot be placed without difficulty in one of the already known old genera and Boissier's opinion is thus fully accepted. Hackel in his Monograph on the *Andropogoneae* placed this plant in the subgenus *Coelorhachis* of the genus *Rottboellia*, but observed already that it might belong to a distinct subgenus *Lasiurus*. The genus of Boissier was during a long time quite monotypic. Recently Hubbard described a second species from East Africa. The long known species *Lasiurus hirsutus* (Forsk.) Boissier has a rather wide distribution from Arabia to British India. Going over the material from the various localities, it is striking that the species is uniform in its western area. Hackel noted already that Arabian specimens have smaller spikelets and says that plants from India and Afghanistan have pubescent nodes and culms being puberulous upwards. Such specimens are not found in its western range, but only in British India and these plants from Scind are accepted by me as a distinct species:

Lasiurus scindicus Henr. nov. spec. with the diagnostic character: Internodia et pedunculi sub paniculam villoso-pubescentes.

BRITISH INDIA: Scind, leg. Stocks. Herb. Ind. Or. Hook. fil. et Thomson. Typus in H. L. B. sub no. 908,87—853.

I have had already often the opportunity to call attention to the fact that the indumentum of the internodes is an important taxonomical character versus glabrous ones. We find the same phenomenon f.i. in the genera *Digitaria*, *Aristida*, *Elyonurus* and *Capillipedium*. *Lasiurus* is certainly not congeneric with *Coelorhachis*, the latter is also accepted by the modern British agrostologists, but not in Pilger's new treatment of the *Andropogoneae*, where *Coelorhachis* (and also *Lasiurus*) are but sections of the genus *Rottboellia*, a method which is certainly not an improvement. *Coelorhachis* is to be accepted as a distinct genus versus

Rottboellia. Some characteristic species of *Coelorhachis* are: **C. aurita** (Steud.) Henr. nov. comb. based on *Rottboellia aurita* Steudel; **Coelorhachis Selloana** (Hack.) Henr. nov. comb. based on *Rottboellia Selloana* Hack.; **Coelorhachis Balansae** (Hack.) Henr. nov. comb. based on *Rottboellia Balansae* Hack.; another species was formerly received from Prof. Parodi as a species of *Manisuris*, which is, however, a new *Coelorhachis*, described here as:

Coelorhachis Parodiana Henr. nov. spec. — Perennis, culmi stricte erecti, elati ad 1.5 m alti, plurinodes, e nodis fere omnibus adpresse ramosi, glaberrimi ut tota planta, vaginae carinatae, compressae, strictae, marginibus hyalinis, ligula albido-fusca, scariosa, glabra, circa 2 mm longa; laminae 20 cm vel plus longae, planae, circa 5 mm latae, multinervosae, scaberulae, sensim acuminatae; inflorescentiae ex omnibus nodis enatae, subcylindraceae, circa 10—12 cm longae, subtenaces, flavovirides, articuli ad 6 mm longi, dorso convexo glabri facie plani; spiculae sessiles circa 6 mm longae, callo brevissimo a reliqua gluma impressione separato, gluma prima coriacea, acuta, leviter bifida, longitudinaliter striata, superne marginata vel anguste alata, gluma IIda uninervis, lanceolata, spicula paulo brevior, dorso carinato-alata, carina laevis, gl. III et IV hyalinae, enerves; spiculae pedicellatae sessilibus conformes sed parum breviores, pedicelli cum articulis haud connati, valde inaequilongi, ei in parte inferiore fere sessiles, superne sensim longiores.

ARGENTINA: Gobernación de Formosa; Las Lomitas (bosques y sabanas subtropicales), in 1928 leg. L. R. Parodi no. 8410. Typus speciei in H. L. B. sub no. 928,150—39.

This species is most allied to *Coelorhachis Balansae* (Hack.) Henr. from Paraguay. Balansa's beautiful type material no. 291 was at my disposal. The new species differs in the leaves, being not scabrous as in *C. Balansae* and in the much striate surface of the lower glumes, which are smooth in *C. Balansae*. A most striking character of *C. Parodiana* was already observed by Parodi on his label, the nearly sessile pedicelled spikelets, so that at first sight each internode of the rhachis bears 2 quite conform spikelets, each nearly sessile and separated from the callus by a linear impression. If we study, however, the whole raceme, we find this character only in the lower half of the spike, gradually upwards the second spikelets become more and more pedicelled and at the top of the spikes the pedicels are quite developed as in other allied species. This phenomenon is found in all the spikes of the plant and represents a distinct character to recognize the species.

Coelorhachis was described as a genus by Brongniart in 1829. He

gave a long description and a plate of his *C. muricata.* This description is quite valid for the genus. He mentioned the pedicelled spikelets with two glumes and the pedicels being free from the rhachis. This agrees with the modern concept and segregation from *Rottboellia*, where these pedicels are fused to the rhachis. In an observation Brongniart says that his genus is intermediate between *Ischaemum* and *Rottboellia*, but that it is nearer to the latter and does not differ "que par le pedicelle de l'épilet stérile qui n'est pas soudé au rachis". Brongniart published the species he had at hand as *C. muricata*, giving a good description and a beautiful plate. Unfortunately he based his *C. muricata* on *Aegilops muricata* Retz. Obs. II. p. 27 (1781) and *Rottboellia muricata* Retz. Obs. III. p. 12 (1783), which was based on the earlier *Aegilops muricata* Retz. This plant of Retzius was not studied by Brongniart, for he says: "outre l'espèce suivante qui ne paraît convenir en même temps à la description que Retzius donne de son Rottboellia muricata et au caractère attribué par M. R. Brown à son Ischaemum Rottboellioides, on doit rapporter à ce genre le Rottboellia Coelorachis de Forster etc.".

Our conclusion is therefore that *Coelorhachis* is to be accepted as a validly published genus being readily recognizable but that the name *C. muricata* (Retz.) Brongn. is not valid being based on a plant, which belongs to a different genus. Brongniart himself did not compare his plant with Retzius's type, he says only "cette plante convient bien à la description fort incomplète que Retzius en a donné". The description by Retzius is indeed very meagre and gives us no sufficient characters to recognize the plant immediately.

Steudel placed in the year 1854 Retzius's plant under *Ischaemum pectinatum* Trin. (1832), a plant which certainly is not a *Rottboellia* or an *Ischaemum*, but belongs to Buse's genus *Eremochloa*. In the year 1856 Buse sharply opposed against Steudel's synonymy in de Vriese's Plantae Ind. Bat. orient., when he accepted the name *Rottboellia muricata* Retzius for the javanese plant, known as *Coelorhachis muricata* Brongn. Buse described at the same time his var. *bandanensis* with pubescent lower glumes. Buse, however, compared only Retzius's description and now there were two opposite opinions on Retzius's species. Hackel studied this question too and we find in his Monograph a treatment quite different to Buse's opinion. *Aegilops muricata* is recognized by him as an *Eremochloa* and the valid combination *E. muricata* (Retz.) Hack. is given. *Coelorhachis muricata* Brongn., however, is given as a synonym under *Rottboellia glandulosa* Trin. (1832), which perfectly agrees with Brongniart's plant and the good plate given by

him. Hackel, however, gave no further information that he has compared the type of Retzius. Recently Pilger accepted Hackel's opinion on this question. Without inspection of the type of Retzius a decision is difficult to make. We know, however, that Retzius mentioned his *Aegilops muricata* as received from India orientalis by the missioner Koenig (his residence was Tranquebar). We know that *Eremochloa muricata* is found in British India (mentioned in the Flora of the Presidency of Madras by Fischer), where Brongniart's plant is not observed. The geographical distribution proves that Hackel's opinion is acceptable and the name of the *Coelorhachis* we are treating here is not valid, being based on a wrong synonym and a totally different species of the genus *Eremochloa*. The correct name of Brongniart's plant becomes therefore *Coelorhachis glandulosa* (Trin.) Stapf ex Ridley Fl. Mal. Penins. V (1925) p. 204.

In the typical plant the lower glume is glabrous. Buse's var. *bandanensis* collected by Reinwardt in the Banda Islands has pubescent lower glumes, but such specimens are also given by Dr. Backer as occurring in Java. Only Buse's type material was studied and is named by me **Coelorhachis glandulosa** (Trin.) Stapf var. **bandanensis** (Buse) Henr. nov. comb.

I must remark that commonly the epithet *glandulosa* is used in various manuals, which is understandable, because Hackel's monograph is accepted. Hooker uses the same name, but he mentions a pedicel adnate to the joint of the rhachis, a character present only in the true *Rottboellias*. Hooker, however, is wrong; I found the pedicel to be free. Properly speaking the genus *Coelorhachis* of Brongniart is destitute of a basis, because the described and figured species does not belong to the *Aegilops muricata* Retz.

We see from this example to what difficulties the strict application of the American type basis concept may lead, difficulties already demonstrated by me under *Paspalum aureum* H. B. K. The difficulties in *Coelorhachis* are still greater, because *Aegilops muricata* Retz. was validly published and has, in connection with an actual type, always priority. Stapf has accepted the genus *Coelorhachis* Brongn. in his Fl. Trop. Afr. IX p. 78 and I also wish to accept it.

If we wish to have a type basis for the genus *Coelorhachis*, we can select a type among other species of *Rottboellia* mentioned by Brongniart, *Ischaemum rottboellioides* R. Br. or *Rottboellia Coelorhachis* Forst. The latter is acceptable on account of Forster's specific name, which has induced Brongniart to give his genus the name of *Coelorhachis*.

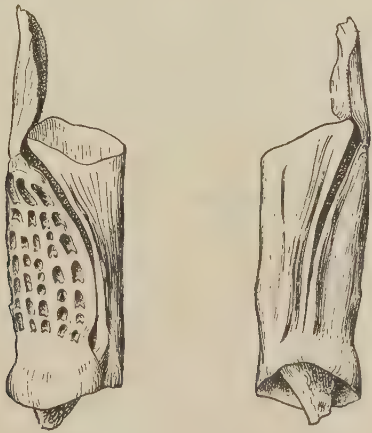
Both species, so far as I saw material, have free pedicels. As to Forster's species we know that Hackel placed it in the group with connate pedicels next to *Rottboellia exaltata*. It may, however, be that Hackel did not see the true *Rottboellia Coelorhachis* Forster, which was described in Labillardière's Sertum austro-caledonicum p. 15, t. 20. Hackel mentioned in his monograph only the Tanna Island (leg. Forster) and the other localities from the literature. Balansa's beautiful material from New Caledonia has free pedicels and agrees with Labillardière's plate. From the Tanna Island (Hackel's specimen) I had a few articulations of the rhachis; here are indeed the pedicels quite connate. It is very probable that this specimen in the Vienna herb., which is not the type of Forster, belongs to another species. For *Rottboellia Coelorhachis* Forst., transmitted to the genus *Coelorhachis* I propose the name **Coelorhachis Forsteriana** Henr. nom. nov.

Rottboellia pratensis Balansa was accurately described by him; he mentioned that the pedicellate spikelets were totally fused with the rhachis and therefore his species is a true *Rottboellia*. The combination *Coelorhachis pratensis* (Bal.) Camus is, therefore, not acceptacle. *Coelorhachis striata* (Nees) Camus, however, belongs to the genus as accepted by Brongniart and Stapf.

It is clear why Miss Camus made this combination. She modified Brongniart's genus and neglected the principal character. She accepted both *Rottboellia* and *Coelorhachis* but differentiated them only on the pedicelled spikelets, being very different from the sessile ones in *Rottboellia* and but slightly different from the sessile ones in *Coelorhachis*. We know, however, that in both genera the pedicelled spikelets are always reduced and therefore much deviate from the sessile ones. Camus's concept of the two genera is, therefore, not acceptable. Her genus *Coelorhachis* is divided into two groups, one with fused and the other with connate pedicels (see Fl. Gén. Ind. Chine, VII, 1922, p. 210 and p. 382). *Coelorhachis muricata* is treated by her on p. 383 but in the key to the 3 species she mentioned the species as *C. glandulosa* without author. I did not accept this as a valid combination but took up that of Stapf in Ridley's Flora. It is noteworthy that a quite correct limitation of the genera *Coelorhachis* and *Rottboellia* was given by Blatter and McCann in Journ. Bombay Nat. Hist. Soc. Vol. XXXIV no. 1 (1930) p. 14.

Other interesting species of *Coelorhachis* are **C. Helferi** (Hook. f.) Henr. nov. comb. based on *Rottboellia Helferi* Hook. f. from Tenasserim; *Rottboellia ophiurioides* Bentham belongs to the genus *Coelorhachis*, its

correct name becomes **Coelorhachis rottboellioides** (R. Br.) Henr. nov. comb. based on *Ischaemum rottboellioides* R. Br. from Australia and the Philippines. A variety **commutata** (Hack.) Henr. nov. comb. occurs also in New Guinea; this variety differs from the typical species by the presence of some verruces near the base of the first glume. *Coelorhachis striata* (Nees) Camus is restricted to British India, a variety var. **pubescens** (Hack.) Henr. nov. comb. is found in the Khasia mountains, where occurs another distinct species **Coelorhachis Khasiana** (Hack.) Henr. nov. comb. based on Hackel's subspecies of that name. The species from Tonkin, which is the *Rottboellia striata* Balansa non Nees, is distinct from the true *C. striata* (Nees) Camus. It is



Coelorhachis clathrata Henr. From type specimen. × 10.

therefore named by me **Coelorhachis clathrata** Henr. nom. nov. This new name is based on the *Coelorhachis striata* (Nees) Camus, as this is described by Miss Camus in Fl. Gén. de l'Indo-Chine VII (1922) p. 383. The beautiful type material collected by Balansa was at my disposal.

Allied to *Coelorhachis* is the genus *Ophiuros* Gaertn. f. The species *O. corymbosus* (L. f.) Gaertn., which must bear the name of *O. exaltatus* (L.) O. K., was limited by Stapf, who separated from it his *O. megaphyllus*. This species occurs in Java, whereas *O. exaltatus* is a species from the Asiatic continent. Stapf described his species in the year 1924 in Haines Bot. Bihar and Orissa. A long description is also to be found in Blatter's Revision of the Flora of the Bombay Presidency

(1927) p. 32. Stapf's species was also described by Elmer as *Rottboellia Tongcalingii* in the year 1915 and this name has priority. The species is therefore to be inserted among our javanese grasses as **Ophiuros Tongcalingii** (Elmer) Henr. nov. comb. based on Elmer's species.

The group to which belongs *Andropogon saccharoides* Sw. is in recent times transmitted to the genus *Bothriochloa. Andropogon barbinodis* Lag. and *A. leucopogon* Nees both placed by Nash in *Amphilophis* belong to the same species, which becomes **Bothriochloa barbinodis** (Lag.) Henr. nov. comb. *Andropogon saccharoides* var. *submuticus* Vasey (vide Hack. Mon. p. 495) is accepted as a distinct species, named *Amphilophis exaristatus* Nash or *Andropogon exaristatus* (Nash) Hitchc. It becomes **Bothriochloa exaristata** (Nash) Henr. nov. comb.

Andropogon perforatus Trin. ap. Fournier and *Andropogon emersus* Fourn. both published in the same year belong to the same species and were both placed by Nash in *Amphilophis. A. emersus* has priority of place and the species thus becomes **Bothriochloa emersa** (Fourn.) Henr. nov. comb. *Andropogon altus* Hitchc. described in 1913 becomes **Bothriochloa alta** (Hitchc.) Henr. nov. comb. *Amphilophis Wrightii* (Hack.) Nash becomes **Bothriochloa Wrightii** (Hack) Henr. nov. comb. *Andropogon Schlumbergeri* Fourn. becomes **Bothriochloa Schlumbergeri** (Fourn.) Henr. nov. comb.

In Notes on Philippine Gramineae (Dep. Bureau of Government Laboratories No. 35, 1905, p. 79) *Pollinia argentea* (Brongn.) Trin. var. *lagopus* Hack. is characterized by its tomentose sheaths at the base of the culms, whereas they are glabrous in the typical *Pollinia argentea*. This plant was earlier mentioned by Pilger in Perkins Fragm. Fl. Philip. (1904) p. 138 as *Pollinia speciosa* and the identification as *Pollinia speciosa* (Deb.) Hack. was certainly given on account of the densely tomentose base of our plant. *Pollinia speciosa* is, however, a different species from the Asiatic continent and Hackel's variety is indeed more allied to the *Pollinia argentea* (Brongn.) Trin. Because the character of the tomentose base in *Pollinia* is a good and important character to recognize various species, I prefer to accept the endemic plant of the Philippines as a distinct species under the name of **Eulalia lagopus** (Hack.) Henr. nov. comb. based on *Pollinia argentea* var. *lagopus* Hackel.

Pollinia articulata Trinius which is the same as *Eulalia contorta* (Brongn.) O. K. is placed by Camus in a distinct genus *Pseudopogonatherum*. Hackel's *Pollinia articulata* subsp. *fragilis* var. *setifolia* based on *Pollinia setifolia* Nees in Hook. Kew. Gard. Misc. 2. p. 88

(1850) is accepted by Camus as a different species named by her *Pseudopogonatherum setifolium* (Nees) Camus. Recently, Pilger placed this species in *Eulalia*, making Camus's genus a section of *Eulalia*. There exists, however, an earlier name for this species, viz. *Andropogon koretrostachys* Trin. (1832). The type was from Manila. Placed in *Eulalia* this species becomes **E. koretrostachys** (Trin.) Henr. nov. comb. I am, however, more satisfied with Camus's opinion that *Pseudopogonatherum* is a distinct genus and I prefer to have the species named **Pseudopogonatherum koretrostachys** (Trin.) Henr. nov. comb.

Among our javanese grasses the genus *Coelachne* is represented by one species mentioned by Backer in his Handboek as *C. pulchella* R. Br. This is a rather common grass in Western and Central Java. If we compare our specimens, abundantly represented from that island, with Australian material known as *C. pulchella* R. Br., we see at once that the javanese plants do no belong to the Australian species. To demonstrate this we must at first know with certainty, what is *Coelachne pulchella* R. Br. Although Brown's type was not seen by me, we know that Kunth received *Coelachne pulchella* from Brown and gave in his Révision des Graminées Tom. II. Tab. 143 a long description and a coloured plate. The Australian specimens of *C. pulchella* I have at my disposal perfectly agree with Kunth's description and plate. Such specimens, however, do not occur in Java. Some striking characters of the Australian species are the subequal glumes both much shorter than the obtuse lemmas and the spikelets on elegant, filiform pedicels. The javanese plants have more unequal glumes and much longer, narrower, acute lemmas. The panicle branches are stiff with shorter, more rigid pedicels.

The javanese grass was afterwards described by Buse as *Coelachne infirma* in the year 1854 and this is the valid name for our javanese species. My opinion that the javanese grass does not belong to *C. pulchella* R. Br. is quite in accordance with that of Stapf, who wrote in 1903 on a plant communicated to him by Koorders: "Coelachne pulchella ex O. Kuntze sed vix" and Koorders determined a month later the plant as *C. infirma* Buse = *C. pulchella* Kuntze non R. Br. Koorders saw Buse's type material at Leiden. It is, however, curious that Koorders determined the same species in 1908 as *Isachne Kunthiana* Wight (Plantae Junghuhnianae ineditae no. 117). Hooker concluded that there is but one known species of this genus. If there are two, the other one would be *C. perpusilla* Thwaites. I saw the latter from Ceylon, it is certainly a very different species with very long and very acuminate

spikelets, especially characterized by its long glumes. Other names found in the literature are *Panicum simpliciusculum* Wight et Arn. ex Steudel, Synopsis (1854) p. 96. This is *Coelachne simpliciuscula* Munro, a species from Ceylon based on Wight no. 2044. This is placed as a variety under *C. pulchella* R. Br. by Miss Camus, the typical *C. pulchella* not being represented in Indo-China. So far as I have seen specimens collected by Balansa, these plants differ by their erect spiciform panicles with tightly adpressed denser racemes. It is also a distinct species, different from the species described by Buse. At the moment Buse's name is therefore quite acceptable.

The genus *Coelachne* was placed commonly in the tribe of the *Aveneae*. Recently Pilger placed it in the *Paniceae* near *Isachne*. Although in habit much agreeing with *Isachne*, the genus *Coelachne* is very well characterized by its short glumes, the long rhachilla between the two flowers and the base of the lower floret, bearing short hairs, the latter character not being found in other *Paniceae*. Its best place is therefore in the tribe of the *Aveneae*.

In the genus *Themeda* there occurs in Java a well-known annual species, which was accepted by Hackel as *Themeda arguens* (L.) Hack., in the supposition that it was the *Stipa arguens* of Linné, as published in the second edition of the Species Plantarum in 1762, mentioning Gramen arguens of Rumphius, tab. 6, f. 1, which is a rough sketch. There is no type of Rumphius, but Linné gave a description of his own from the specimen in his herbarium, giving the locality as India only. A reexamination of this type by Merrill proved that the plant of Linné was not the javanese species as described by Hackel, but the same as *Anthistiria ciliata* L. f., a grass from British India, Bourbon and Mauritius. Hence the javanese grass had to bear another name and it actually being the *Anthistiria frondosa* R. Br., Merrill gave it the name of *Themeda frondosa* (R. Br.) Merr. The true *Stipa arguens* L. does not occur in Java. It is now a curious fact that the name *Themeda arguens* (L.) Hack. is the valid one for the British Indian annual grass, commonly known as *Themeda ciliata* (L. f.) Hack., which was named by Kuntze as *Themeda quadrivalvis* (L.) O. K. The most important synonymy of *Stpia arguens* L. is, therefore, as follows:

Themeda arguens (L.) Hack. in D. C. Monogr. (1889) as to the combination not as to the description by Hackel, which applies to the annual *Themeda frondosa* (R. Br.) Merr.

= *Stipa arguens* L. Sp. Plant. ed. II (1762) p. 117.

= *Andropogon quadrivalvis* L. Syst. Veg. ed. XIII (1774) p. 758.

= *Themeda quadrivalvis* (L.) O. K. (1891).
= *Anthistiria ciliata* L. f. Supplem. Plant. (1781) p. 113.
= *Themeda ciliata* (L. f.) Hack. Monogr. (1889) p. 664.
= *Andropogon nutans* L. Mantissa Plant. II (1771) p. 303 non Linné Spec. Plant. (1753) p. 1045.
= *Andropogon scandens* Roxb. Fl. Ind. (1832) p. 248.
= *Andropogon semiberbis* Nees Fl. Afr. austr. (1841) p. 125.

The three genera *Lophopogon*, *Sclerandrium* and *Apocopis* are recently more sharply defined by Hubbard. The first two genera are not represented within our region. The genus *Apocopis*, however, mainly found on the Asiatic continent too, has a species from Borneo, described by Ridley as *Apocopis borneensis*. The type was collected by Winkler (no. 3392). This species of Ridley is however the same as *Apocopis collina* Balansa, described already in 1890 (Type is Godefroy 389 from Cochinchina). It is a perennial species. I received a short time ago from Dr. Backer interesting material of an *Apocopis* found in Sumatra. The occurrence of a species of *Apocopis* in Sumatra is important because the genus is not known from Malaya. The Sumatran *Apocopis* was collected in the province Atjeh near Blang Rakal, which is a very sterile open grassy plain at an altitude of about 600 m. Mr. Jochems collected the plant in the year 1924. According to the collector, there were but few specimens growing together with *Arundinella*, *Pollinia*, *Andropogon*, *Themeda*, *Imperata* and *Rhynchospora*. Another sample from the same locality indicated as "along the Gajoeroad near milestone 33" is according to Mr. Jochems but 400 m above sealevel. These plants were collected by J. C. v. d. Meer Mohr, no. 3247. Both collections were named by Dr. Backer as *Apocopis Wightii* Nees. Compared with Hackel's treatment of this species I could unfortunately not verify this, the species not being represented in our collections. It is said by Hackel, Hooker and Camus to be an annual. The plants collected by v. d. Meer Mohr, however, are in my opinion perennials. Hackel's subspecies *mangalurensis* was seen by me from Maisur and Carnatic (Hooker's Apocopis no. 4). This plant represents a distinct species **Apocopis mangalorensis** (Hochst.) Henr. nov. comb. based on *Amblyachyrum mangalorense* Hochst. in Flora, Vol. 39 (1856) p. 26.

Apocopis was described by Nees in 1841 with one species *A. Royleanus* Nees as the type. This species has to bear the name of *A. paleaceus* (Trin.) Hochr. Watson made the combination *Apocopis himalayensis* (Steud.) Watson in 1882, based on Steudel's *Andropogon himalayensis* from the year 1854. Steudel gave however *Apocopis Royle-*

anus Nees as a synonym of this species, so that Watson's combination is invalid. At the same time Steudel, who accepted *Apocopis* Nees as a section of *Andropogon*, described an *Andropogon courtallumensis* indicating it as a perennial and giving *Apocopis Wightii* Nees MS. as a synonym. This name, although accepted by Hackel is invalid and the species must bear Steudel's name which was accompanied by a description. Hence the correct name of this species becomes **Apocopis courtallumensis** (Steud.) Henr. nov. comb. based on Steudel's *Andropogon* under this name.

Another genus abundantly represented in Java is *Arthraxon* P. B. As it is treated by Hackel, it consists of 8 species. One of them, *A. jubatus* Hack. is a very curious one only known to me from the type locality. The other species are in the course of time often variously interpreted. There are now more than 20 species; one was described in 1784 as *Phalaris hispida* Thunberg. Makino made the new combination under *Arthraxon* for the Japanese plant and afterwards Merrill did the same for the plant from the Philippines. Both plants as accepted by Makino and Merrill are, however, not the same. According to Hackel, *Phalaris hispida* Thunb. is the *A. ciliaris* subsp. *Langsdorfii* (Trin.) Hack. fide specim. in H. Havn., which is *Pleuroplitis Langsdorfii* Trin. or *Arthraxon Langsdorffiana* (Steud.) Hochst. The same species of Trinius was also the *Arthraxon ciliaris* P. B. If we compare the material in herbaria, we find that the true *Arthraxon hispidus* (Thunb.) Makino does not occur in Java, but is an inhabitant of Japan and China, whereas the *A. ciliaris* P. B. has a wide range. The differences are that in the true *A. hispida* the awns are what we call "imperfect", that is short, not differentiated into a column and a subula, whereas in *A. ciliaris* P. B. the awn is perfect, with a distinctly twisted column, a bend and a long subula. Synonyms of *A. hispida* (Thunb.) Makino are *Pleuroplitis Langsdorfii* var. *submutica* Regel and Hackel's var. *cryptatherus*. This one was found introduced in N. America.

Honda treated Beauvois's species in Journ. Fac. of Science, Tokyo, Vol. III (1930) p. 328. He states that *Ischaemum ciliare* Retz. is a synonym of Beauvois's name, which is totally wrong. It is incomprehensible, how Honda came to this conclusion. Beauvois gives in his Essay on p. 111 a description of his genus *Arthraxon* and mentioned one species *A. ciliare* also figured by him. Beauvois tells us that the species was communicated to him by Richard and was only represented in Richard's herbarium, being formerly cultivated by Richard's uncle at Trianon. Beauvois says further only: "Elle me paraît avoir des rap-

prochements avec l'Ischaemum ciliare des auteurs, mais elle ne peut rester dans le même genre puisq'elle a des caractères opposés". We therefore may doubt, whether Honda has understood this sentence? Beauvois figured his species with perfect awns and with quite glabrous articulations of the rhachis. His species is quite identical with *Pleuroplitis Langsdorfii* Trin.; Trinius mentions the arista tortilis, his figure gives the articulations as glabrous too.

Miquel's *A. japonicus* described in 1867 is a mixture, partly belonging to *A. hispidus* (Thunb.) Makino, partly to *A. ciliaris* P. B. According to our investigations *A. ciliaris* and *A. Langsdorfii* have both perfect awns and glabrous articulations and therefore the latter is only a synonym. Our javanese species is therefore *Arthraxon ciliaris* P. B. The other allied species with hairy articulations and perfect awns is *A. Quartinianus* (Richard) Nash, a species accepted also by Stapf. A subspecies of *A. Quartinianus* is ssp. **Vriesii** (Buse) **Henr.** nov. comb. based on *Lucaea Vriesii* Buse. It is only found in Java.

The javanese annual *Arthraxon* with small spikelets (3—3½ mm) must bear the name *A. lancifolius* (Trin.) Hochst. All other javanese species of *Arthraxon* have larger spikelets (4—7 mm) and are perennials. Their discrimination offers no further difficulties. Two new species were recently acquired. I describe them here as follows:

Arthraxon linifolius Henr. nov. spec. — Probabiliter annua, culmi erecti vel adscendentes elegantes, simplices vel a basi ramosi, multinodes, glaberrimi, usque ad apicem foliati; vaginae arctae, internodiis multo breviores, nodis barbatis, patento-pilosi, pilis basi tuberculatis, marginibus ciliatis; laminae conformes, anguste lineares vel lineari-lanceolatae, 1—2 cm longae, 2 mm latae, superne setaceo-acuminatae, inferne rotundatae vel leviter auriculatae, pilosae, marginibus ciliatis pilis tuberculatis, ligula albo-scariosa; paniculae depauperatae breviter exsertae, terminales vel hinc inde laterales, circa 2 cm longae, inconspicuae, e 10—12 spiculis compositae; spiculae sessiles bene evolutae, pedicellatae ad pedicellam brevissimam, vel circa 1—1½ mm longam, haud ciliatam, inferne tantum appresse puberulam redactae, rhachis articuli leviter curvati, scaberuli vel inferne minute appresse puberuli; spiculae anguste lineares, 4 mm longae, vix ½ mm latae, inferne stramineae, enerves, superne pallide virides multi-nervosae, callo minute pubescente, a latere subcompressae, glabrae vel superne ad margines scaberulae vel leviter ciliolatae, gluma prima acuta, apice hyalino integra, carinis ciliiferis, secunda acuminata aequilonga, quarta aristata, arista 7 mm longa, perfecta, columna circa 4 mm longa inclusa vel

vix exserta, valde torta, brunnea, subula 3—5 mm longa, exserens, pallida, stigmata prope basin spicula emergentia.

Papua: Boridi, open places, 3800 feet, 21. X. 1935 leg. C. E. Carr no. 14643. Typus speciei in H. L. B. sub no. 936,267—460.

This new species has a very characteristic habit, there are probably but 2 small anthers.

Arthraxon pallidus Henr. nov. spec. — Planta tota pallide glauco-viridis, culmi glaberrimi, multinodes, vaginae striatae, arctae, glabrae, marginibus ciliatis, nodis pubescentibus; laminae ovato-lanceolatae, glabrae, amplexicaules, 2—2½ cm, interdum 4 cm longae, ad 7 mm latae, marginibus superne scaberulis, inferne pilis basi tuberculatis remote ciliatis, apice cuspidato-acuminatae; panicula longe exserta, pedunculo tenuissimo compresso glabro, spicae spuriae 2—4-nae, breviter pedicellatae vel subsessiles, raro solitariae, 4—5 cm longae; articuli filiformes glabri vel inferne pilis perpaucis praediti, spiculae pedicellatae vix evolutae, stipitiformes, glabrae vel inferne pilis paucis suffultae, spiculae sessiles, 4—4.5 mm longae, angustae, callo breviuscule barbulato, stramineae, gluma prima inferne glabra, superne secus nervos, praesertim marginibus echinulata. Arista perfecta circa 9 mm longa, columna torta brunnea vix vel parum e glumis exserta subulam pallidam subaequante.

Nova Guinea: Morobe, Sattelberg, hills about mission houses, 3000 ft. Nov. 20, 1935, sine no. leg. J. et M. S. Clemens.

A distinct *Arthraxon* at once striking by its pale glaucous colour, allied to members of the *Arthraxon ciliaris* group. It may be that this species is the same as Bentham's *A. ciliaris* var. *australis* Benth. (Fl. Austral. III, p. 524). Bentham's description pretty well agrees with my plants. Bentham's Australian type of his variety from New South Wales was not seen by me.

When Stapf treated *Arthraxon Quartinianus* (Rich.) Nash in the Fl. of Trop. Africa, he excluded the varieties *Hookeri* and *glabrescens* of Hackel. The var. *Hookeri*, described from the Sikkim and collected by Hooker was named *Bathratherum echinatum* Nees. I could verify this var. *Hookeri*, which belongs to a distinct species **Arthraxon Hookeri** (Hack.) Henr. nov. comb. It is not allied to *A. Quartinianus* Nash, having small anthers about ½ mm long, 1 mm long sterile pedicels, 11-nerved lower glumes and longer spikelets. The var. *glabrescens* was not seen by me.

A very interesting question as to the distribution of allied species is the case of *Panicum trichoides* Swartz. This is a well-known tropical

American species found from Mexico to Brazil. Being an annual weed it is no wonder that it is introduced elsewhere and observed also in tropical regions of the Old World. This species has in the New World always sparingly, very characteristically hirsute spikelets. There is an allied species with glabrous spikelets, which occurs only in the tropics of the Old World (the Malayan region). At the time that this species (a small one too) was observed, no taxonomist brought this plant in connection with a New World one. This rather rare species was found in Christmas Island (south of Java) and described as *Panicum Andrewsi* Rendle. It has quite glabrous spikelets and Rendle had therefore no reason to look for his species among New-World ones. The species was published in Christmas Island Monograph (1900) p. 192 with a plate (pl. XVIII). When now the New World species becomes introduced as a weed in Java, the student of the javanese grasses meets two different things, one as a native, and another, the introduced one, but since they agree so very much in habit and most of the other characters he does not recognize them as two distinct species and is inclined to accept them as but one somewhat variable species. In such a case it is to understand that in a local flora as f. i. Backer's Handbock we meet *Panicum trichoides* Sw. indicated from tropical America, and subspontaneous or introduced in many other tropical regions. The description (l. c.) in this case mentions f. i. glumes and sterile lemmas sparingly hairy or glabrous, in contradiction to the true *P. trichoides* Sw., which has in its native country always hirsute spikelets. The true situation becomes therefore confused and two acceptable, distinct, although very much allied species are not recognized and in the case of the javanese grasses, the endemic one becomes classified among a species from a different region. The geographical distribution of all the species of a group, however, helps us greatly to disentangle such difficult questions and it is a fact that in such a case the geographical distribution induces us to study minute differences more exactly; these minute differences are present in such a case even to a greater extent. The true *Panicum trichoides* Sw. f. i. has the axis of the panicle sparsely pilose, the spikelet always sparsely hirsute, the lower glume ½ as long as the spikelet and 1-nerved, the second and third glume 3-nerved, the spikelets 1.2—1.3 mm long, the immature fruit minutely papillose. The endemic species *P. Andrewsi* Rendle, which has at first sight quite the same habit, has usually a glabrous panicle axis; the second and third glume are mostly 5-nerved, the spikelets perfectly glabrous and slightly larger viz. 1.75 mm long. There is often

an empty palea ½ the length of glume III, such a palea is often wanting in the American species, but it is not a constant character. Although the differences between the two species are small, we are justified in accepting here two distinct species, *Panicum Andrewsi* Rendle and *P. trichoides* Sw. Further field studies may prove, how variable both are and what are the absolutely constant characters to recognize them always. For the time being the best character is the absence or presence of the hairs on the spikelets. This is a good character for discrimination, as *P. trichoides* from the New World is never observed with glabrous spikelets.

Panicum Andrewsi Rendle was collected by Dr. C. A. Backer at Soerabaja near Grisee in 1925 (Backer n. 37536 in H. L. B.). It was collected in the same year also by the Soemba Expedition near Laora by the native collector Iboet (no. 339). This specimen much resembles *Panicum brevifolium* L. in habit, which is a perennial with a lower glume about as long as the spikelet. *Panicum trichoides* Sw. from the New World is introduced into the Asiatic continent (abundantly seen in Balansa's collections). From Java I saw specimens collected near Pasoeroean (Backer no. 36934) and Kraksaän (Backer no. 13083). The same species was already collected by R. Brown near Koepang on Timor in 1803 (ex herb. British Museum).

Balansa's *Panicum amoenum* was hitherto only known from the Asiatic continent (Tonkin and Cochinchina). I could study Balansa's own beautiful material. This species is now also found in Celebes. It was found already in the year 1840 along roads near Tondano by Forsten. I found it to be Balansa's species, when I tried to identify the specimens. Other localities were detected in British North Borneo on Mount Kinabalu by J. and M. S. Clemens during the years 1931—1933. I saw 3 numbers (Clemens 28275, 28275A and 51562), all collected at medium altitudes. I accepted them as *Panicum perakense* (Hook. f.) Merr. based on Hooker's variety *perakense* of *Panicum humidorum* (see Ridley Fl. Mal. Penins. Vol. V. p. 226). I found the species to be Balansa's *P. amoenum*. Although Hooker's variety has priority, it must, accepted as a species, bear Balansa's name.

Ichnanthus P. B. is a universally accepted genus in all our manuals and although formerly various species were described under *Panicum* by Nees and Trinius, the genus was never seriously criticized. The typical species of the genus such as *I. panicoides* P. B. and *I. leiocarpus* (Spreng.) Kunth are sharply defined on account of the flap-like appendage of the fertile lemmata. These species constitute

the group of the *Appendiculata* Pilger. In the other section, the *Foveolata* Pilger appendages are lacking. In their place we find characteristic scars at the base of the fertile lemma. *Ichnanthus* was intensively treated by Chase in her study on the *Paniceae.*

There are, however, a great many species of *Panicum* with more or less distinct scars at the fruits, and such species of *Panicum* were never brought in connection with the genus *Ichnanthus.* We have but to compare the various figures in Hitchcock and Chase's work on *Panicum.* I mention this question, because there is an interesting grass in South America, which is so variously treated and so misunderstood even by competent agrostologists. Doell described in 1877 this species as *Ichnanthus breviscrops* on account of the scar. Afterwards it was found in British Guiana by Hitchcock and described by him in 1922 as a new species *Panicum magnum.* This species was also found in Dutch Guiana and Hitchcock, when he treated the grasses of the High Andes, identified his *Panicum magnum* with *Ichnanthus breviscrops* Doell, which occurs also in Bolivia. Recently Pilger accepted Doell's species as a *Panicum* and made the combination *P. breviscrops* (Doell) Pilger. We see from these observations, how difficult it was to find the correct place of the species, which depends on the value we give to the scar at the base of the lemma. Yet the question was not settled, since Pilger placed this *Panicum breviscrops* not only in *Panicum* but in a subgenus *Acroceras*, which is accepted in modern times as a distinct and characteristic genus. Even if we accept *Acroceras* only as a subgenus of *Panicum,* we cannot place *Panicum breviscrops* in this subgenus, because Doell's species has scars at the base of the lemmas. Moreover, if we study Doell's species and Hitchcock's *Panicum magnum,* we find that the summit of the fertile lemma does not agree with the characters of *Acroceras.* It is quite evident that Doell's plant is not an *Acroceras,* it has the scar of *Ichnanthus* and further no other characters of *Acroceras,* no crest neither at the top of the lemmata, nor on the glumes. Further studies may prove, whether Doell's species is to be placed in *Panicum* or in *Ichnanthus.* A new combination in the genus *Acroceras* is not acceptable. In this matter I call attention to a former treatment of the genus *Acroceras* in Blumea.

The genus *Prionachne* was published by Nees in 1836 in Lindley's Nat. Syst. of Botany p. 447 with one species *P. Ecklonii.* In 1841 Nees changed the name of the genus and substituted for it *Chondrolaena* in Agrost. Cap. p. 133 with a synonymy which is appliable to his *P. Ecklonii.* Desvaux described the same genus however in his Opusc. p. 64. tab.

IV—f. 3 in 1831 as *Prionanthium* with *P. rigidum* Desv. as the type. He gave the locality as Ind. Orientalis. This generic description has priority and *Prionanthium* is accepted in modern times by Stapf and others. The *Phalaris dentata* L. f. Suppl. p. 106 (1781) and the same one in Thunberg's Prodomus (1794) and Flora capensis is however a member of the genus *Prionanthium. Phalaris dentata* L. f. was misunderstood by Nees, Trinius, Steudel and others and identified with Nees's *P. Ecklonii.* Thunberg's species is however a rare species and different from Nees's one. Thunberg's name has however priority and the rare species has to bear the name of **Prionanthium dentatum** (L. f.) Henr. nov. comb. based on *Phalaris dentata* L. f.

In my former article I did not mention Steudel's *Panicum rhabdinum* (Synops. p. 96) which was given with the synonym *Isachne virgata* Nees MS. Steudel, who did not accept the genus *Isachne* could not use the specific name *virgatum* on account of the existing *Panicum virgatum* L. He named the species *Panicum rhabdinum.* If this is a distinct species it must be named **Isachne rhabdina** (Steud.) Henr. nov. comb. If we accept the plant as a var. of *Isachne pangerangensis* Z. et M. I propose for the javanese plant the name **I. pangerangensis** Z. et M. var. **rhabdina** (Steud.) Henr. nov. comb.

The genus *Ottochloa* is very characteristic and all its members are, as to the structure of the spikelets rather uniform. I quite agree with Dandy's treatment of the four species. Recently another very characteristic species was described from Queensland by Hubbard. Through his kindness I received beautiful material of this Australian species so that all the members of *Ottochloa* hitherto known are represented in the material at my disposal. On account of the structure of the spikelet, being so much the same, in the different species, the various members are segregated on vegetative differences and arrangements of the spikelets in the inflorescences. A key for the determination of the existant species was never prepared and I therefore wish to give such a key from the material at hand for the benefit of those who have to identify the plants of this genus.

Key to the species of Ottochloa.

1a. Spikelets small, only 2 mm long, branches of panicle very thin and elegant 2

b. Spikelets longer, more than 2 mm long, branches of panicle stouter, more stiff and rigid 3

2a. Panicle branches undivided, solitary, short, up to 3.5 cm long, forming together a rather small exserted panicle, 3—5 cm (rarely up to 9 cm) long;

leaves light green on both surfaces, small, 2—5 cm long, scarcely 5 mm broad . . . . **O. gracillima** Hubb.
Range: Queensland. Endemic. Specimens seen: Hubbard 2144, 2341, 2807, 8070, 8666. See Hubbard in Kew Bulletin 1934, p. 445.

b. Panicle branches often divided near the base, solitary and binate or verticillate, long, 10—12 cm long, leaves dark on upper surfaces, pale beneath, long, up to 9 cm long and 8 mm broad . . . **O. malabarica** (L.) Dandy
Range: Indo China and China. Specimens seen: Types of Balansa's *Panicum nodosum* var. *micranthum*, Balansa 480, 1609, 1610.

3a. Branches of inflorescence reiterately branched, forming an open panicle with scattered pedicelled spikelets which are only somewhat congested at the end of the branches . . . . **O. nodosa** (Kunth) Dandy
Range: Indo China, Borneo, Philippines. Specimens seen: Tonkin: Type of Balansa's *P. ouombiense*; Balansa 451, 478, 1613, 1614, 1615 — Borneo, Kinabalu: Clemens 30274, 51222 — Philippines: Bureau of Science, Ramos et Edano 44043.

b. Branches of inflorescence single, the branchlets if present very short, the spikelets densely clustered or crowded along their whole length, forming false spike-like racemes 4

4a. Panicle branches very long and naked at their base, the clusters of spikelets very remote, with long internodes, spikelets broadly ovate, greenish, hairy or glabrous . . . . **O. Arnottiana** (Nees) Dandy
Range: widely distributed from British India and Ceylon to Tonkin, Java, Borneo, Philippines and New Guinea.
Specimens seen: East Himalaya: Griffith 6489 — Ceylon: Balansa — Tonkin: Balansa 450, 479, 1611, 1612 — Java, very abundant: Koorders 40705, 41150, 42249; Bakhuizen van den Brink 5008, 5164, 5414; Backer 10044, 18704, 18818, 18892, 22144; near Buitenzorg, common, Balansa, Kurz, Backer; Schiffner 1539, 1582; Hallier 611 a—c, 622; Junghuhn (type of *Digitaria urochloides* Buse); Mousset 87 — Brit. N. Borneo: Ramos 1133 — Philippines: species Blancoanae Merrill 944; Merrill 4182, 9378, 9581, 11600; Ramos 12040, 21713 (depauperate specimens); Ramos et Edaño 44235; Kneucker exc. Merrill 817; Elmer 16496 — Papua: Carr 11832.

b. Panicle branches long, not naked at their base or only slightly so, clusters of spikelets very densely crowded, not or scarcely remote, but very slightly interrupted, spikelets brownish, glabrous . . . **O. fusca** (Ridley) Dandy
Range: Malaya, Sumatra, Borneo, Philippines.
Specimens seen: Malaya: Yapp 238 (Kelantan Kwala Aring) — Sumatra: Lörzing 6873 — Borneo: Amdjah 424; Winkler 3464, 3247 — Philippines: Ramos et Edano 43890 — Papua: Carr 11622.

One of the rather difficult genera is also the genus *Chrysopogon* and especially the polymorphic species *C. Gryllus* (L.) Trin. The five subspecies of Hackel are at present accepted as distinct species. Beside *Chrysopogon Gryllus* we have *Chrysopogon echinulatus* (Nees) Watson, *Chrysopogon pallidus* (R. Br.) Trin., *Chrysopogon glabratus* Trin. and **Chrysopogon calcaratus** (Hack.) Henr. nov. comb. based on Hackel's subspecies of this name. The latter is characterized by the

very long callus of the hermaphrodite flower and also by the long scar after the spikelets have fallen off. *Chrysopogon glabratus* Trin. differs from all the other members of this group in the only about 1 mm long awn of gl. II of the sessile spikelet. According to Hubbard Bentham's *Chrysopogon Gryllus* is a distinct species. Hackel had already some doubts about Bentham's species when he said "fortasse aliae varietates" and Pilger said recently "mit mehreren Varietäten vielleicht Arten". Hubbard, when he treated a new species from Queensland in Hooker's Icones Tab. 3365, gave an account of Bentham's species of *Chrysopogon*. Hubbard says that the species which Bentham named *C. Gryllus* represents an undescribed species, whilst *C. Gryllus* var. *pallidus* (R. Br.) Benth. is also quite distinct.

Bentham's *Chrysopogon Gryllus*, being described, we can give it another name: **Chrysopogon Benthamianus** Henr. nom. nov. See Bentham Fl. Australiensis Vol. VII (1878) p. 537.

Andropogon Gryllus was also recorded from the Philippines by Villar. As the species ranges eastward only to Northern British India and is not found in Indo China, it is probable that plants, from more eastern and southeastern localities, belong to different species. Merrill described an *Andropogon Gryllus* L. var. *philippinensis* from Panay. He saw already that the typical *A. Gryllus* did not occur in the Archipelago. Having seen the cited number of Merrill's variety, I accepted this as a distinct species under the name of **Chrysopogon philippinensis** (Merr.) Henr. nov. comb. This is a robust species with many noded culms and long leaves. It can at once be distinguished by the much smaller spikelets. Hitherto only seen from the type locality (Ramos et Edano no. 30964).

A species of *Chrysopogon* was also detected in Malaysia already in the year 1925 by the Soemba expedition. It is certainly allied to other members of the *Gryllus* group and characterized by its thin and elegant few-noded culms and its still smaller spikelets. I describe it here as a new species.

Chrysopogon tenuiculmis Henr. nov. spec. — Perennis, caespitosa; culmi erecti vel leviter geniculati, glabri, binodes, tenues, $1/2$—$3/4$ mm diametro, cum panicula usque ad 40 cm longi; folia ad basin culmorum congesta, vaginae carinato-compressae, valde nervosae, praesertim marginibus pilosae, laminae lineares, usque ad 10 cm longae, ad $2^1/_2$ mm latae, superne parum angustatae, subobtuse acuminatae, marginatae, planae sed subcanaliculatae, pilis sparsis albis conspersae, ligula brevissima, ciliolata, auriculae distinctae; laminae culmeae breviores, reductae;

inflorescentia abbreviata, circa 5 cm longa, subcontracta vel subeffusa, rhachi sublaevi, subangulata, ramis subverticillatis paucis, usque ad 2 cm longis, in axillis glabris, superne dilatatis vel cupulatis; racemi omnes pedunculati, ad spiculam hermaphroditam unam duasque masculinas vel neutras redacti, interdum in singulis ramulis pauciarticulati, spiculae sessiles hermaphroditae anguste lanceolatae, circa 5 mm longae, luteae, callus acutus 1 mm longus, pilis flavescentibus 2 mm longis barbatus; gluma inferior convexa, apice bifida, in setas duas 3 mm longas terminata, cartilaginea, glaberrima et superne prope margines aculeolis paucis praedita, gluma superior cartilaginea apice subacuta, gluma III hyalina, gluma IV aristata, arista ad 22 mm longa, bis geniculata, columna scabra brunnea ad 10 mm longa, in setulam subaequilongam abiens; spiculae pedicellatae steriles vel masculinae, lineari-lanceolatae, purpureae, acutae, 5 mm circa longae, pedicelli lineares, plano-convexi spicula brevior, laeves, gluma inferior acuminata aristata, arista 3—4 mm longa, caduca, 3—5-nervis supra medium asperula, gluma superior subbrevior, acuta haud aristata, gluma III hyalina vel nulla.

SOEMBA: prope Kendara, 29. III. 1925, leg. Iboet no. 151. Typus speciei in H. L. B. sub no. 927,344—414.

In *Chrysopogon* the lower glume of the sessile spikelet is commonly unawned, whereas the second one is distinctly awned, in *C. tenuiculmis* we find the inverse position, the lower glume is bifid with two long setae, the upper one is unawned. The javanese *Chrysopogon subtilis* (Steudel) Miquel has still smaller spikelets, the sessile ones with the normal position as in other species of *Chrysopogon*.

Another species of *Chrysopogon*, found in Borneo, is a member of a different group which is characterized by the densely bearded lateral pedicels of the male spikelets. Hitherto no species of this section was found in our Archipelago. In Hackel's Monograph six species of this group are treated. Their synonymy is rather intricate. Hackel's first species of this group is *Andropogon nodulibarbis* Hochst. According to the synonymy this was described by Steudel thrice in his Synopsis, viz. as *Andropogon peninsulae* Steud. (with *Chrysopogon Arnottianus* Nees as a synonym), based on Wallich cat. no. 8785A, further as *Andropogon nodulibarbis* Hochst. with as type Hohenacker's no. 934 from the Nilgeri Hills and finally as *Andropogon zeylanicus* Nees MS. sub Rhaphis from Ceylon. The absolute priority of place has *Andropogon peninsulae* Steudel no. 422 on p. 396; Steudel's no. 423 is *Andropogon nodulibarbis* and Steudel's no. 426 on pag. 397 is *Andropogon zeylanicus* Nees which name was accepted as *Chrysopogon zeylanicus* (Nees) Thwaites in 1864

in the Enumeratio Plant. Zeylaniae p. 366. I saw Perrottet's number 1323 also mentioned by Hackel which is incorporated in our herbarium as **Chrysopogon nodulibarbis** (Hochst.) Henr. nov. comb. Other authentic specimens were not seen and thus I could not exactly identify Steudel's *Andropogon peninsulae*. In the recent literature the name *Chrysopogon zeylanicus* (Steud.) Thwaites is accepted f. i. by Trimen in his Supplement and by Fischer in Gamble's Flora of the Presidency of Madras, part X (1934) p. 1737—1738. Hackel's second species is *Andropogon verticillatus* Roxb. = *Chrysopogon verticillatus* Trin. This species is a robust plant with often bearded nodes and long leaves. Another species is *Andropogon aristulatus* Hochst., a nomen nudum changed by Steudel to *A. breviaristaus* (probably a misprint for *breviaristatus* as given in his Index). Type is Hohenacker 1285. The correct name for this species is *Chrysopogon orientalis* (Desv.) Camus. I could compare this species abundantly. Another species of this group, but not treated by Hackel, is *Andropogon asper* Heyne ex Hook. f. Fl. Br. Ind. VII (1897) p. 189. Placed in *Chrysopogon,* it becomes *C. asper* (Heyne) Blatter et McCann.

This is according to Fischer (in Fl. of Madras) doubtfully distinct from *C. orientalis*. All the species treated here are robust plants with large spikelets and long pedicelled male or neuter spikelets, these pedicels are longer than ½ the length of the sessile spikelets, mostly they are ¼ shorter than the sessile ones. There remain now six species, three are mentioned by Hackel, three others are described by Hooker. All have the pedicels of the lateral spikelets less than half as long as the sessile ones. It is in this group that the species from Borneo mentioned above has to be placed but none of them agree with the material or the descriptions in the literature. *Chrysopogon collinus* Ridley insufficiently described was not available for comparison. I am therefore obliged to accept the species from Borneo as a new one:

Chrysopogon borneensis Henr. nov. spec. Perennis, caespitosa, culmi floriferi et steriles edentes, sine paniculis ad 20 cm alti, multinodi, singuli vel e basi ramosi, nodis obtectis; vaginae internodiis longiores, compressae, carinatae, valde nervosae, glabrae, marginibus hyalinis, ligula valde abbreviata, minute ciliolata, auriculae leviter productae; laminae complicatae, glabrae sed inferne ad margines pilis nonnullis albis longis praeditae, 4—6 cm longae, statu complicato 1 mm latae, anguste lineares, superne aequilatae, haud acuminatae, obtusae sed subcucullatae; inflorescentia parva pedunculo gracillimo, 3—4 cm longa, subcontracta vel subpatens, racemis verticillatis capillaribus,

glabris, in axillis minute puberulis vel glabris, superne leviter incrassatis vel cupulatis, rami paniculae cum spicula fertili, in singulo ramulo, singula, oblique articulati, cicatricem minute rufociliatam exhibentes; spiculae pallidae hermaphroditae sessiles sine arista calloque 1 mm longo, 3—5 mm longae, callo lateraliter fuscobarbato, gluma prima inferne laevis, superne striata vel nervata, subotusa, marginibus glabris haud ciliatis, gluma secunda in setam pallidam 4 mm longam abiens, gluma IV aristata, columna torta, brunnea, bisgeniculata, 10 mm longa, in setam pallidam 10 mm longam producta; spiculae laterales masculinae 5 mm longae, glabrae, pedicellis 2—3½ mm longis lateraliter fusco-barbatis, superne sub spiculam longe rufo-barbatis, gluma prima acuminata vel leviter aristulata, aristula vix 1 mm longa, gluma II brevior, aristulata.

BORNEO: West-Koetai, alt. 100 m. leg. Endert no. 5271. Typus in H. L. B. sub no. 940,101—29.

Index

INDEX [1])

to Vol. IV

compiled by

JOSEPHINE TH. KOSTER

(Synonyms in italics, new names in heavy type).

[1]) Index to "The Charophyta of Malaysia and adjacent countries" by J. S. Zaneveld on p. 215, to "Miscellaneous notes on Loranthaceae, 25" by B. H. Danser on p. 318, to "Note on the Sapotaceae-Mimusopoideae in general, etc." by H. J. Lam on p. 357, to "Notes on the nomenclature of some grasses II" by J. Th. Henrard on p. 535.